1 9 8 3

FIELD CROP RECOMMENDATIONS FOR MANITOBA

MANITOBA AGRICULTURAL SERVICES COORDINATING COMMITTEE

Agriculture Canada has a number of Canada Agricultural Services Coordinating Committees (CASCC) whose function is to provide a vehicle for recommendations on a wide range of agricultural activities including research to Agriculture Canada. Under each CASCC committee, referred to as Canada Committees are a number of "expert committees" who meet on an annual basis. They provide recommendations to CASCC and to coordinate the great diversity of agricultural activities.

On the provincial level, similar organizations exist. In Manitoba the over-all committee is the Manitoba Agricultural Services Coordinating Committee (MASCC). This main committee is composed of a number of "lead" committees each with a number of sub-committees. The lead committee chairmen are automatically designated as members of the main MASC Committee. There are a number of duties allocated to the lead committees but their main function is to act as a vehicle for recommendations that are passed to MASCC. In turn, MASCC selects, priorizes, and passes them to the appropriate Canada Committees, particularly where Agricultural Canada action is requested.

The Crop Science Lead Committee of MASCC has an additional function of providing crop variety recommendations, a duty assumed by the Agronomists' Conference in the past. The various sub-committees under the Crop Science Lead Committee provide the necessary expertise, review the data and propose variety recommendations on cereal, special, and forage crops grown in Manitoba. These recommendations are discussed, ratified, or rejected at an annual meeting of the Crop Science Lead Committee at which all members of the sub-committees are expected to attend. The final crop variety recommendations are printed annually in the Field Crop Recommendations for Manitoba.

MASCC's Soil Science Lead Committee provides a similar function in proposing recommendations on all aspects of fertilizer applications and rates. These are also contained in the *Field Crops Recommendations* booklet.

The Agronomy Conference no longer assumes the responsibility of Field Crop Recommendations but functions as a forum for agricultural scientists, extension workers, and farmers to participate in an exchange of information.

This publication is designed to provide up-to-date recommendations for growing field crops. Additional information is available in printed form from Manitoba Agriculture. Contact your local Agricultural Representative office, or write to:

MANITOBA AGRICULTURE
Publications Distribution
411 York Avenue
Winnipeg, Manitoba, R3C 3M1
Telephone: (204) 944-3845

Ask for the *List of Publications* and information on a specific crop.

CONTENTS

Introduction

6 Use of Good Seed
6 Disease Control
8 Crop — Disease Relationships
9 & 10 Seed Treatment - Fungicides and Insecticides
11 Weed Control
12 Weed Control in Cereals, Oilseeds and Special Crops
13 Insect Control

Fertilizer Use

15 Soil Testing

15 Major Nutrients for Annual Crop Production
19 Micro-Nutrients
19 Organic Soils
20 Calculation of Fertilizer Rates

21 **Zero Tillage**

23 **Metric Calibrations**

24 **Metric Conversions**

25 **Related Publications and Information**

Cereal Crops

26 Barley
29 Oats
31 Rye
33 Triticale
35 Wheat
37 Winter Wheat

Oilseed and Special Crops

40 Buckwheat
41 Canaryseed
42 Canola-Rapeseed
46 Fababeans
47 Field Beans
49 Field Peas
51 Flax
53 Lentils
55 Mustard
57 Potatoes
60 Soybeans
62 Sugar Beets
65 Sunflowers
68 Wild Rice
69 **Corn**

Forage Crops

78 Recommended Grass Varieties
81 Recommended Legume Varieties

TABLES

1 Crop — Disease Relationships
2 Seed Treatment Fungicides and Insecticides
3 1983 Field Crops Chart — Recommended Herbicides
4 Recommended Insecticides on Field and Forage Crops
5 Common Fertilizers
6 Herbicides for Sugar Beets
7 Performance of Corn Hybrids
8 Herbicides for Corn
9 1983 Forage Crops Chart — Recommended Herbicides

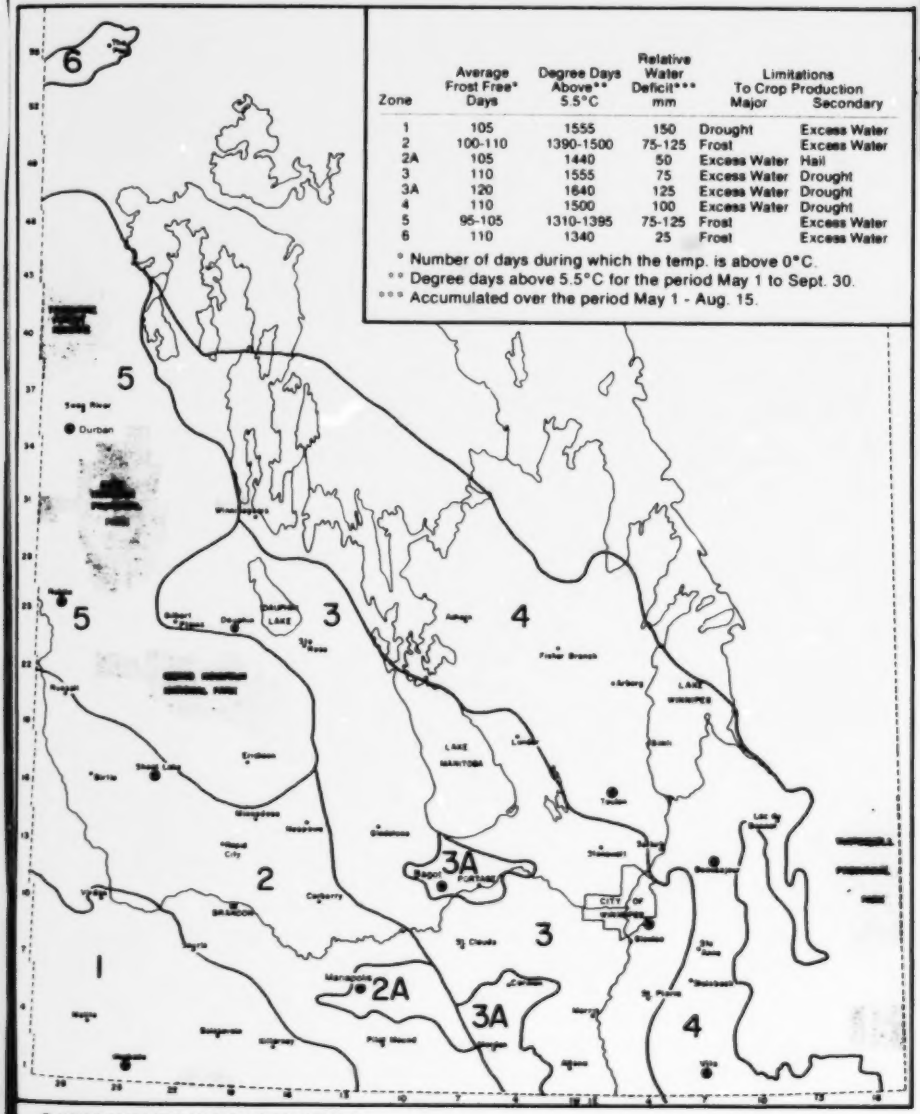
FIGURES

5 Crop Variety Zone Map for Manitoba
71 Corn Heat Unit Map for Manitoba
72 Minimum Accumulation of Corn Heat Units at a 25% Risk
73 Minimum Accumulation of Corn Heat Units at a 10% Risk

CROP VARIETY ZONE MAP FOR MANITOBA

Zone	Average Frost Free* Days	Degree Days Above** 5.5°C	Relative Water Deficit*** mm	Limitations To Crop Production Major	Secondary
1	105	1555	150	Drought	Excess Water
2	100-110	1390-1500	75-125	Frost	Excess Water
2A	105	1440	50	Excess Water	Hail
3	110	1555	75	Excess Water	Drought
3A	120	1640	125	Excess Water	Drought
4	110	1500	100	Excess Water	Drought
5	95-105	1310-1395	75-125	Frost	Excess Water
6	110	1340	25	Frost	Excess Water

* Number of days during which the temp. is above 0°C.
** Degree days above 5.5°C for the period May 1 to Sept. 30.
*** Accumulated over the period May 1 - Aug. 15.



● CROP VARIETY ADAPTATION TRIALS.

INTRODUCTION

Use of Good Seed

Always use good, preferably pedigreed seed of a recommended variety. Pedigreed seed consistently outyields poorly cleaned seed. Thorough cleaning removes weed seeds and most diseased kernels and retains only the large kernels which produce larger, more vigorous plants. A cost comparison of farm-grown seed versus Certified seed is presented on page 87.

Disease Control

Seed Treatment Chemical seed treatments can be used to control diseases and insects, such as smuts which attack wheat, barley, oats and rye, and flea beetles that infest canola, rapeseed and mustard.

In control of smuts, seed of resistant varieties, and seed of susceptible varieties free of smut should not require treatment. No yield benefit results from treating sound seed of a resistant variety with a seed treatment. When smut is observed in a crop being used for seed, it should be treated. If a producer uses his own seed of a susceptible variety and there is doubt as to infection by smut or bunt, seed treatment is a wise precaution. The recommended interval between treatments is given for the various crops under Disease and Insect Control

Use a suitable chemical with a Pest Control Products Act number (PCP No.). Recommended chemicals are shown in Table 1. Seed treatment chemicals are poisonous so guard against inhaling dust or fumes, and wear a mask where recommended on the product label. Wash with soap and water periodically to remove chemical lodging on hands and face while treating.

Thoroughly clean equipment used in moving treated grain before it is used for untreated grain. Empty containers of chemicals should be crushed and buried at least 50 cm (20 inches) deep in a place where they will not contaminate water supplies.

CAUTION: Treated grain must not be mixed with untreated grain for feed or sale. Treated leftover seed may be saved for planting the following year; otherwise it should be buried at a depth and location where it will not be accessible to animals or contaminate water supplies.

Sclerotinia Diseases *Sclerotinia sclerotiorum* can cause serious disease in a great variety of broadleaved field crops including fababeans, field beans, field peas, lentils, mustard, canola, rapeseed, soybeans and sunflower. Vegetable crops such as green beans and garden peas, along with many weeds such as thistles, wild mustard, ragweed, and burdock are hosts.

The pathogen overwinters in Manitoba soils by means of black, hard bodies or sclerotia, variable in shape (round, flat, short, elongated) and size measuring from a few millimetres to several centimetres. Infection is caused in two ways:

- by direct mycelial germination,
- by airborne ascospores produced by inconspicuous, tiny mushrooms or apothecia.

Direct mycelial germination causes root infection and occurs primarily in sunflower. This infection results in root rot and basal stem rot, noticeable by a wet lesion at the stem base and a sudden wilting of the plant. Infection by ascospores causes head and stalk rot in sunflower, and white mold or stem rot in other crops. Ascospore infection occurs under conditions of continuous heavy rainfall inducing development of apothecia and release of ascospores.

Airborne infections are conditioned further by the presence of senescent tissue such as florets of sunflower heads and flower petals of other crops that drop and become lodged in leaf axils. Senescent tissue is needed by the germinating ascospore, and serves as a food base for the infection to be successful.

Sclerotinia diseases are partially controlled by rotation allowing at least four years between host crops, use of seed free of sclerotia, and with weed control. Airborne infections are further reduced by plantings allowing maximum air circulation and fast drying, and by timely sprays with recommended chemicals on approved crops. In sunflower, damage due to Sclerotinia wilt is reduced by using minimum populations planted at maximum distances (refer to sunflower section — under seeding).

Crop Rotations Alternating of broadleaf and cereal crops is generally recommended; specific cases are discussed under individual crops elsewhere in this publication. Further information on crop rotation can be obtained from the bulletin. *Disease Considerations in Crop Rotations* and the *Crop Rotation Chart*.

A table detailing some common diseases of field crops in Manitoba follows (Table 1). It shows which occur on more than one crop and the longevity of these diseases in the field in the absence of a susceptible host.

TABLE 1 CROP — DISEASE RELATIONSHIPS

DISEASES	CROP																				
	ALFALFA	BARLEY	BUCKWHEAT	CORN	FABA BEANS	FIELD BEANS	FIELD PEAS	FLAX	LENTILS	MUSTARD	OATS	POTATOES	RAPESEED	RYE	TRITICALE	SOYBEANS	SUGAR BEETS	SUNFLOWERS	SWEET CLOVER	WHEAT	LONGEVITY *
Ascochyta Blight					A		B		C												4
Alternaria-Grey Leaf Spot										X			X								1
Bacterial Blight						A	B									C					1
Cyst Nematode										X			X				X				3
Ergot		X												X	X					X	1
Fusarium Wilt & Root Rot	X				X	X	X	X	X	X			X			X		X	X		S
Gibberella — Fusarium Head Rot		X		X																X	S
Helminthosporium — Common Root Rot		X																		X	2
Rhizoctonia Root Rot	X		X		X	X	X	X	X	X		X	X			X	X	X	X		S
Sclerotinia	X[1]				X	X	X		X	X		X	X			X		X	X[1]		4
Septoria (Cereals)		X																		X	1
Verticillium Wilt	X											X						X	X		4
White Rust-Staghead										A			B								3

Diseases with different letters have same name on various crops but are caused by different species or biotypes of the pathogen. This implies that there is little risk of this disease spreading between the indicated crops.

* = longevity of pathogen in soil or on trash in years.

S = pathogen is a soil organism and can survive indefinitely.

X[1] = uncertain.

TABLE 2 — SEED TREATMENT FUNGICIDES AND INSECTICIDES

ACTIVE INGREDIENT	TRADE NAME	INSECT: WIREWORMS: Wheat	Oats	Barley	Rye	Flax	SEED MAGGOT: Field Beans	Corn	Soybeans	FLEA BEETLES: Canola (Rapeseed)	Mustard	DISEASE: SEED AND SEEDLING ROTS/BLIGHTS: Canola (Rapeseed)	Mustard	Peas	Cereals	Barley	Flax	Rye	Corn	Field Peas	Soybeans	SMUTS CARRIED ON SEED: Rye-Stem Smut	Wheat-Bunt	Oats-Smut	Barley-Covered	Barley-False Loose	SMUTS CARRIED IN SEED: Wheat-Loose Smut	Barley-Loose Smut	BLACK LEG: Canola (Rapeseed)	Mustard	VERTICILLIUM WILT: Alfalfa
INSECTICIDES																															
carbofuran (Gr)	Furadan									●	●																				
FUNGICIDES																															
captan (Du, Wp)																			●	●	●										
carabathiin (Sn)	Vitavax																●					●	●	●	●	●	●	●			
(Su)	Vitaflo 250															●	●	●					●	●	●	●	●	●			
carabathiin-thiram (Du)	Vitavax powder																●	●			●	●	●	●	●	●	●	●			
(Su)	Vitaflo 280																●	●	●		●	●	●	●	●	●	●	●			
maneb (Du, Su)															●	●	●	●					●	●	●	●					
mancozeb (Wp)	Dithane M45															●		●					●	●	●	●					
metiram (Du, Su)	Polyram																●						●	●	●	●					
thiram (Wp, Su)	Thiram											●	●	●			●		●	●	●										●

TABLE 2 — SEED TREATMENT FUNGICIDES AND INSECTICIDES

ACTIVE INGREDIENT	TRADE NAME	INSECT: WIREWORMS: Wheat	Oats	Barley	Rye	Flax	Field Beans	INSECT: SEED MAGGOT: Corn	Soybeans	INSECT: FLEA BEETLES: Canola (Rapeseed)	Mustard	DISEASE: SEED AND SEEDLING ROTS/BLIGHTS: Canola (Rapeseed)	Mustard	Peas	Cereals	Barley	Flax	Rye	Corn	Field Beans	Soybeans	DISEASE: SMUTS CARRIED ON SEED: Rye-Stem Smut	Wheat-Bunt	Oats-Smut	Barley-Covered	Barley-False Loose	DISEASE: SMUTS CARRIED IN SEED: Wheat-Loose Smut	Barley-Loose Smut	DISEASE: BLACK LEG: Canola (Rapeseed)	Mustard	DISEASE: VERTICILLIUM WILT: Alfalfa
DUAL PURPOSE																															
benomyl-captan lindane (Du)	Gammasan																														
benomyl-thiram lindane (Du)	Thiralin + Benolin R									•	•	•	•																•		
captan-lindane (Du)							•		•	•	•	•	•							•	•								•		
captan-lindane-diazinon (Du)								•												•	•										
carabathiin-thiram (Du)	Vitavax dual powder	•	•	•	•											•	•					•	•	•	•		•	•			
lindane (Su)	Vitaflo	•		•																											
carabathiin-thiram-lindane (Du, Su)	Vitavax RS																					•	•	•	•		•	•			
maneb-lindane (Du)		•	•	•	•					•				•	•	•	•												•		

FOOTNOTES: Gr – Granules
Du – Dust
Wp – Wettable Powder
Su – Suspension
Sn – Solution

Weed Control

Recommendations on weed control must be combined with proper identification of the weed problem, good cultural practices and crop rotations. Refer to the Manitoba Agriculture publications *Guide to Chemical Weed Control* and *Field Sprayers*.

For further information consult your Agricultural Representative, Weed or Crop Specialist from Manitoba Agriculture, the Plant Science Department, University of Manitoba; Agriculture Canada, the local Weed Supervisor or chemical industry technical and sales representatives.

Guidelines for Successful Weed Control

- Clean, repair and calibrate the sprayer early in the season.
- Check the crop weekly, after emergence, to identify the weed problem.
- Use the correct herbicide.
- Apply herbicides at the proper stage for maximum weed control and crop safety.
- Use Amine formulations of 2,4-D or MCPA for greater crop safety and to reduce the volatility hazard.
- Avoid spraying on windy days, particularly near susceptible crops.
- Always read and follow herbicide label instructions.
- Do not mix the chemicals unless stated on the label.
- Mix the herbicide solution in the spray tank for 15 minutes before starting to spray by using the sprayer by-pass to circulate through the tank. The spray pump must have sufficient capacity to continue circulation through the by-pass during the spray operation.

Herbicide Residues

Several recommended herbicides will leave a residue in the soil which may restrict cropping options for one or more years after application. See the Guide to Chemical Weed Control, the Crop Rotation Chart and product labels for detailed information.

TABLE 3 — 1983 FIELD CROPS CHART — RECOMMENDED HERBICIDES

HERBICIDES \ CROPS AND WEEDS	CROPS															
	CEREALS					OIL SEEDS					OTHER					
	Barley	Oats	Rye	Triticale	Wheat	Flax	Mustard	Rapeseed (Canola)	Soybeans	Sunflowers	Bean, Field	Canary Seed	Fababeans	Lentils	Peas	Tame Buckwheat
Afolan Lorox + MCPA amine	X	X			X	X[1]										
Amiben + Treflan									X[2]	X[2]						
Asulox F						X										
Avadex BW	X				X	X	X	X							X[3]	
Avenge 200C	X				X[4]							X				
Banvel + MCPA or 2,4-D	X	X[5]			X											
Basagran						X			X		X		X		X	
Basfapon/Dalapon/ Dowpon/Dowpon M						X		X							X	X[6]
Benazolin								X								
Blagal	X	X			X	X										
Brominal M/Bromox 450M/ Buctril M	X	X			X	X						X				
Carbyne 2 EC/Wypout/ Wypout 250	X				X[7]	X	X	X		X			X	X	X	
Dyvel	X	X			X											
Eptam						X[8]				X[8]	X[2]					
Estaprop	X				X											
Hoe-Grass	X[9]		X	X	X	X	X	X	X	X[10]	X		X	X	X	X
Kil-Mor	X	X			X											
Lexone/Sencor	X[11]				X									X[12]		
Mataven				X	X[13]							X				
MCPA	X	X	X		X	X									X[14]	
NaTA TCA/TCA solution	X	X				X		X							X[15]	
NaTA TCA + MCPA or 2,4-D	X	X[5]				X[5]										
Pardner/Torch	X	X		X	X	X						X				
Premerge/Sinox/ Yellow Stuff											X		X		X	
Sencor + Treflan													X[8]			
Stampede 360	X	X			X	X										
Stampede CM	X	X			X	X										
Target	X	X			X											
Tordon 202C	X				X											
Treflan	X[16]				X[16]	X[17]	X[8]	X[8]	X[8]	X[8]	X[8]		X[8]	X[17]	X[8]	
Tropotox Plus															X	
2,4-D	X		X		X											

LEGEND: CROPS

X Recommended on crop. See Guide for rates.

1 Use Lorox only.
2 Apply in spring only.
3 Field peas only.
4 Glenlea, Neepawa, Selkirk, Chester, Macoun, Canuck and Benito only.
5 Use MCPA only.
6 Use Basfapon only.
7 Do not use Wypout 250 on Park spring wheat.
8 Apply spring or fall.
9 Do not use on Klages, Betzes, Norbert or Glenn.
10 Do not use on Corona.
11 Do not use on Klondike.
12 Use Sencor only.
13 Do not use on Selkirk wheat.
14 Use sodium salt only.
15 Use on field peas only.
16 Post-plant incorporated to control green and yellow foxtail only.
17 Apply in fall only.

TABLE 4 — RECOMMENDED INSECTICIDES ON FIELD AND FORAGE CROPS

Crop	Guthion	Thiodan	Furadan	Dimethoate	Dylox	Malathion	Sevin	Lannate	Lorsban	Monitor	Temik	Counter	Supracide	Ambush	Decis
Alfalfa			X	X	X	X				X					
Barley			X	X	X	X	X	X	X					X	
Corn							X	X	X						
Faba Beans															
Flax			X	X	X			X	X					X	
Mustard			X			X									
Oats			X	X	X	X	X	X	X						
Pastures			X	X		X									
Peas				X		X									
Potatoes	X	X	X	X		X	X		X	X			X	X	
Canola	X		X	X	X	X		X	X	X		X	X	X	X
Rye				X		X	X								
Sugar Beets	X		X		X	X			X		X	X			
Sunflowers	X	X	X						X					X	
Sweet Clover			X			X	X								
Wheat			X	X	X	X	X	X	X						
INSECTS CONTROLLED	Flea beetle, Sunflower beetle, Diamond back moth, Colorado potato beetle	Sunflower beetle, Colorado potato beetle	Grasshoppers, Sunflower beetle, Flea beetle, Colorado potato beetle, Root maggots	Grasshoppers, Aphids, Plant bug, Leafhopper	Beet webworm, Plant bug, Diamond back moth, Armyworm	Grasshoppers, Aphids, Armyworms, Diamond back moth	Sweet clover weevil, Armyworm, European corn borer, Colorado potato beetle, Blister beetle	Bertha armyworm, Armyworm, Clover cutworm, Beet webworm	Cutworm, Bertha armyworm	Bertha armyworm, Colorado potato beetle, Plant bugs	Root maggots	Root maggots, Flea beetles	Flea beetle, Colorado potato beetle	Colorado potato beetle, cutworms	Flea beetles

For more specific information, refer to the 1983 Manitoba Insect Control Guide.

Insect Control

Information on control of insect pests of field crops and stored grain can be obtained from these bulletins:

Field Crop Insects and Their Control, Agdex 622, Manitoba Agriculture

Control of Insects and Mites in Farm Stored Grain, Agdex 674, Manitoba Agriculture

Grasshopper Control in Manitoba, Agdex 605, Manitoba Agriculture

Questions about other insects which may cause problems should be referred to the Manitoba or Canada Agriculture.

Publications on insect control may be obtained from the Publications Distribution Centre, Manitoba Agriculture, 411 York Avenue, Winnipeg, R3C 1T5

Fertilizer Use

Most crops when the available nutrient level of soil is low, respond well to fertilizer. Stubble fields are usually low in nitrogen and phosphorus. Fallow fields usually have adequate nitrogen but are low in phosphorus. Many fields may be low in sulphur and some may also be low in potassium. On the other hand, where high rates of fertilizer have been used for a number of years the level of available nutrients may be adequate to meet crop requirements.

The recommendations for maximum fertilizer rates which can safely be applied with the seed have been established with granular fertilizers using double disc drill seeding equipment. Using this method, fertilizer is placed close to the seed. Discers, hoedrills and air seeders vary in their ability to accurately place seed and fertilizer. Use discretion in increasing recommended maximum rates of fertilizer with the seed if the contact between fertilizer and seed is less than that obtained with a double disc drill. The safe rates of fertilizer applied with the seed may also increase if fertilizer is applied in solution, rather than as granular fertilizer.

Soil Testing

For specific recommendations on individual fields, have your soil analyzed. Obtain details of sampling procedures from your agricultural representative's office or your fertilizer dealer. Cost of routine testing ranges from $7 to $14 depending on tests required. Send your sample to:

Provincial Soil Testing Laboratory
Ellis Building
University of Manitoba
Winnipeg, Manitoba R3T 2N2

For further details see Manitoba Agriculture factsheet *Soil Testing Services in Manitoba*, Agdex 533.

Major Nutrients For Annual Crop Production

Nitrogen Nitrogen fertilizer is effective in increasing both yield and protein content. Application at a rate of 75 kg/ha (67 lb/acre) or less to soils low in available nitrogen results mainly in yield increases. When soil available nitrogen levels are high or more than 60 kg/ha (54 lb/acre) nitrogen is applied, both yield and protein content are increased.

The effectiveness of nitrogen in increasing yield and/or protein content is significantly affected by the time of application and method of placement. The various nitrogen carriers are about equally effective in increasing yields and/or protein content of annual crops when applied in a manner that minimizes nitrogen losses. The greatest efficiency of all nitrogen fertilizers is obtained when the fertilizers are banded into the soil at or near seeding, or applied in the seed row.

NOTE: The amounts of various nitrogen fertilizers which can be applied with the seed without seedling damage are given with the fertilizer recommendations for each crop. Urea and liquid or dry fertilizers containing urea should be well covered with soil to minimize losses. Apply anhydrous ammonia and aqua ammonia at depths of 10 to 15 cm (4 to 6 inches) and apply only when soil conditions permit a good seal behind the applicator shanks.

Relative Efficiencies of Time and Method of NitrogenApplication

The relative efficiency of nitrogen fertilizers as affected by the time of application and the method of placement varies greatly from year to year. Average relative values of times and methods of application when spring broadcast nitrogen is given a value of 100, has been calculated as follows:

Time and Method	Relative Value
Spring broadcast	100
Spring banded	120
Fall broadcast	82
Fall banded	93

For further details see Manitoba Agriculture factsheet *Nitrogen Fertilization in Crop Production*, Agdex 541.

Phosphorus Most Manitoba soils are phosphorus deficient and so give yield responses to fertilizer phosphorus application. The response to phosphorus by any crop is affected by factors such as:

- root development and distribution
- ability of the plant to take up soil and fertilizer phosphorus
- the method of phosphorus application
- the soil available phosphorus level
- soil type (soil texture, pH and carbonate content)
- soil water and temperature

Ideally, plants need a good supply of phosphorus close to the seed during the first month of growing and an adequate quantity of phosphorus in the soil for the rest of the season.

Placing sufficient quantities of phosphorus with the seed or close to the seed have been the traditional methods for phosphorus fertilizing annual crops in Manitoba. This has been found to satisfy both early growth requirements and provide a reserve of phosphorus for the balance of the growing season.

Increasing the amount of phosphorus applied annually above that normally recommended (banded or broadcast) will increase the soil available phosphorus. It could be increased to high or very high levels so that yields would not be significantly affected by phosphorus deficiency. The number of applications or years of phosphorus fertilization required to increase soil available phosphorus to high or very high levels is unknown for most soils. Soil testing at regular intervals is a good way to monitor the available phosphorus level.

CAUTION: High rates of applied fertilizer phosphorus (annual rates in excess of 150 kg/ha (134 lb/acre) P_2O_5 may induce a micro-nutrient deficiency if soil levels of micro-nutrients are marginal (for example, zinc and copper).

Phosphorus Banded With The Seed Banding of fertilizer phosphorus with the seed results in the greatest yield increase per unit of phosphorus for all crops providing the amount applied is not injurious to the germinating seedling. Crops such as cereals will tolerate all their fertilizer phosphorus requirements placed with the seed.

Phosphorus Banded Near The Seed Banding fertilizer phosphorus near the seed (beside and/or below) results in the greatest yield increase per unit of phosphorus when amounts in excess of those tolerated with the seed are required. Phosphorus placed in this manner is recommended for most oil-seeds, annual legumes and row crops.

Phosphorus Deep-banded Deep banded phosphorus; phosphorus banded at about the 10 to 15 cm (4 to 6 inches) soil depth and in spacings of 30 cm (12 inches) or less prior to seeding is more effective in increasing yields than phosphorus broadcast and incorporated. Applications of nitrogen with the phosphorus should increase the availability of fertilizer phosphorus.

NOTE: Take care not to disturb the phosphorus bands during tillage and seeding operations.

Phosphorus Deep-banded with Nitrogen Nitrogen applied with the phosphorus will increase fertilizer phosphorus availability. Band these fertilizers together when both nitrogen and phosphorus are needed. Application of 10 to 15 kg P_2O_5/ha (9 to 13 lb/acre) with or near the seed may also be required to insure adequate supplies of phosphorus for early growth.

Phosphorus Surface Applied and Incorporated Surface incorporation of fertilizer phosphorus results in the lowest yield increase per unit of phosphorus. The amount applied broadcast must be greater than amounts applied with or near the seed to obtain equal yield increases in the year of fertilizer application. Since the amount of phosphorus used during the first number of years has to be increased two to fourfold to equal yield increases from placement near the seed, broadcast application of phosphorus may be uneconomic on many soils.

Additional information is contained in the Manitoba Agriculture factsheets *Phosphorus Fertilization in Crop Production*, and *Phosphorus Application for Annual Crops*, Agdex 541.

Potassium Most Manitoba soils contain sufficient available potassium for crop production. Soils likely to contain insufficient potassium are the coarse textured soils (sands to sandy loams) and organic soils. Additional fertilizer potassium may be required on about five to seven per cent of arable Manitoba soils for maximum production of the commonly grown annual crops such as cereals, rapeseed, and flax and on 25 to 40 per cent of soils for the production of the special annual crops such as corn, potatoes, and sugarbeets and the horticultural fruit and vegetable crops. Potassium where required, can increase crop yield and quality. Depending on the type of crop, it may increase frost and disease resistance, palatability, storage, quality, etc. A soil test is recommended to determine whether a potassium application is warranted in any specific situation.

Within limits allowable for each crop, place potassium fertilizers in the seed row or side banded whenever possible for the most efficient use of fertilizer by annual crops. The method and amount of potassium application for specific crops are given with the general fertilizer recommendations for each crop. The efficiency of broadcast potassium is about one-half of that applied with the seed. If potassium is being broadcast, double the rate of application of the rate recommended for seed placement or side banding to obtain equal crop response. If broadcast, incorporate potassium fertilizer into the soil.

Sulphur Well drained sandy soils and grey luvisol (grey wooded) soils are frequently sulphur deficient. Sulphur deficiency may occur in many other soils and in any area of the province. Because of this a soil test is recommended to establish the available sulphur status of your fields.

Crops vary greatly in their sulphur requirements. Canola (Rapeseed), mustard, corn, potatoes, sugarbeets, horticultural crops, and forages containing a legume component have a higher sulphur requirement than cereal grains or flax. Sulphur deficiencies are more likely to occur in crops having a high sulphur requirement. These crops also have a greater tendency to deplete the sulphur in the soil resulting in a low supply of available sulphur for subsequent crops. This is particularly true following breaking of a perennial forage stand.
Sulphur fertilizer recommendations are based on sulphur being applied in the sulphate ($SO_4=$) form since it is the only form readily available to plants. Some nitrogen and phosphorus containing fertilizers contain sulphate sulphur; for example, 21-0-0 (24S) and 16-20-0 (14S).

Sulphur in the elemental form, as it occurs in some high analysis sulphur products such as flaked or prilled elemental suplhur (99% S), flowers of sulphur (99%S) or granular sulphur (90%S) is not available to plants until oxidized to the sulphate form. Oxidation of sulphur requires time and depends on soil temperature and moisture, size of sulphur granule and the rate at which granules break down in the soil. Recent research has found that sulphur from these products does not become available in sufficient quantities to meet crop requirements in the year of application. Therefore, they are not recommended to be applied on soils with a low available sulphur content where the crops would require the applied sulphur to be available in the immediate year of application.

Ammonium thiosulphate; 12-0-0 (26), is a liquid formulation containing 26 per cent sulphur by weight. One-half of the sulphur converts into the readily available sulphate form and the remainder into finely divided elemental sulphur. This product can be applied to supply sulphur at the rate recommended for sulphate sulphur.

Micro-Nutrients

The majority of mineral soils in Manitoba contain sufficient micro-nutrients for most crops. Farmers should not apply micro-nutrient fertilizers unless they have established that deficiencies exist through consultation with extension agronomists, a soil analysis, and conducted small scale trials.

The Manitoba Soil Testing Laboratory offers a soil micronutrient analysis service. The cost for a copper-zinc-iron-manganese soil analysis is $7 per field, if in addition to a routine soil test. These tests are performed only when specifically requested. Proper soil sampling and sample handling procedures are important.

Additional information is contained in the Manitoba Agriculture factsheet *Micro-nutrients in Crop Production,* Agdex 541.

The Manitoba Soil Testing Laboratory offers a Plant Tissue Analysis Service. Plant tissue analysis is useful in evaluating fertilizer management programs and practices, diagnosing nutrient related crop production problems, and identifying nutrient levels in crops that may limit top yield achievement. It is also especially useful in evaluating and identifying potential micronutrient problems.

Cost ranges from $3.50 per sample for a nitrogen only analysis to $16.50 for a complete 10 nutrient analysis. Proper plant sampling and sample handling procedures are important. Detailed information on Plant Tissue Analysis and complete instructions for sampling procedures are contained in the Manitoba Agriculture factsheet *Plant Tissue Analysis,* Agdex 533.

Organic Soils

Crops such as barley, oats, Canola (Polish type) and grasses perform better than wheat and flax due to the colder microclimate on organic soils.

Most organic soils are very deficient in phosphorous and potassium. Farmers on organic soils should use the higher rates of phosphate and potassium recommended in this booklet for each crop.

Organic soils are frequently deficient in copper and may also be deficient in manganese and boron. Use both soil and plant analyses as aids in determining if these micro-nutrients are deficient. Conduct small scale trials (micro-nutrients applied to portions of a field) to assess the effects of micro-nutrient fertilizers on crop yields before micro-nutrients are used on large land areas. Recommendations for micro-nutrient fertilizer use in these trials and in instances where deficiencies exist are:

Copper Apply 5 to 15 kg/ha (4 to 13 lb/acre) copper, (for example, 20 to 60 kg/ha, 18 to 54 lb/acre copper sulphate). Spray dissolved copper sulphate and incorporate well into the surface

15 cm (6 inches) of soil. Research indicates that applying copper fertilizer in the solution form is superior to its application in granular form. After soils have been fertilized two or three times with copper, have both a soil and a plant analysis to determine if excessive copper accumulation has occurred.

Manganese 10 to 15 kg/ha (9 to 13 lb/acre) manganese, (for example, 40 to 60 kg/ha, 36 to 54 lb/acre manganese sulphate) should be drilled with the seed of cereals and banded away from the seed of rapeseed and grasses.

Boron Incorporate 1 to 2 kg/ha (1 to 2 lb/acre) boron, (for example, 9 to 17 kg/ha; 8 to 15 lb/acre borax) with the surface 15 cm (6 inches) of soil.

Calculation of Fertilizer Rates Fertilizers are labelled by percentage according to their guaranteed minimum analysis in terms of nitrogen (N), phosphate (P_2O_5) and potash (K_2O).
For example, 11-48-0 (2) contains 11 per cent nitrogen by weight, 48 per cent phosphate by weight, 0 per cent potash by weight, and approximately 2 per cent sulphur by weight. The actual weight of nutrients in 100 kg (220 lb) fertilizer is: *N = 11 kg, (24 lb), P_2O_5 = 48 kg (106 lb) and K_2O = 0 kg, and S = 2 kg (4 lb) approximately.*

For example:

1. Using 11-48-0(2)
   Rate of P_2O_5 desired = 22 kg/ha (20 lb/acre)

   $$\text{Rate of fertilizer} = \frac{22 \times 100}{48} = 46 \text{ kg/ha}$$
   $$= \frac{(20 \times 100)}{(48)} = (42 \text{ lb/acre})$$

   46 kg/ha (42 lb/acre) of 11-48-0(2) would also supply nitrogen at the rate of

   $$\frac{11 \times 46}{100} = 5.1 \text{ kg/ha} \quad ; \quad \frac{(11 \times 42)}{(100)} = (5 \text{ lb/acre})$$

   and sulphur at the rate of

   $$\frac{2 \times 46}{100} = 0.9 \text{ kg/ha} \quad ; \quad \frac{(2 \times 42)}{(100)} = (0.8 \text{ lb/acre})$$

2. Using 34-0-0
   Rate of N desired = 45 kg/ha (40 lb/acre)

   $$\text{Rate of fertilizer required} = \frac{45 \times 100}{34} = 132 \text{ kg/ha}$$
   $$= \frac{(40 \times 100)}{(34)} = 117 \text{ lb/acre)}$$

Additional information is contained in the Manitoba Agriculture factsheet *"Calculating Nutrient Costs and Fertilizer Rates"*, Agdex 540.

TABLE 5 — COMMON FERTILIZERS

NOTE: The number in brackets denotes the approximate percentage of sulphur in the fertilizer.

Liquids (solutions)	
Ammonium phosphate	10-34-0
Nitrogen solution	28-0-0, 32-0-0
Aqua ammonia	20-0-0
Ammonium thiosulphate	12-0-0-(26)
Gas (compressed)	
Anhydrous ammonia	82-0-0
Dry (solids)	
Ammonium phosphate	11-48-0(2), 11-51-0, 11-55-0
Ammonium phosphate sulphate	16-20-0(14)
Ammonium nitrate phosphate	17-34-0, 23-23-0, 25-25-0
Urea ammonium phosphate	19-39-0
Diammonium phosphate	18-46-0
Urea ammonium phosphate	27-27-0; 34-17-0
Ammonium nitrate phosphate sulphate	26-13-0(3)
Ammonium nitrate phosphate	27-14-0; 28-14-0
Ammonium sulphate	21-0-0-(24)
Ammonium nitrate	34-0-0
Urea-ammonium sulphate	34-0-0(11)
Sulphur coated urea	40-0-0(6)
Urea	46-0-0
Potassium chloride	0-0-60; 0-0-62
Calcium sulphate (Gypsum)	0-0-0(13 to 19)
Sulphur (clay base)	0-0-0(90)

In addition to these premixed fertilizers, micro-nutrients and specially blended fertilizers including suspensions are available from some fertilizer dealers.

Zero Tillage

Zero tillage crop production involves the planting of a crop into untilled stubble land with minimal soil disturbance and if necessary, chemical weed control. Generally, any system causing more than 25 per cent disturbance of the surface soil is not considered zero tillage.

Research trials and farmer experience have shown that zero tillage provides an alternate method of production for wheat, barley, flax, and rapeseed where tillage reduction is desirable to conserve moisture, reduce soil erosion, reduce fuel and labor inputs, or reduce populations of annual weeds. Zero tillage can be practised on most soil types. However, wet heavy clay soils may cause difficulties in seeding resulting in inadequate crop stands.

Field experience has shown that trash management and fall weed control are extremely important the fall before zero tillage crop production.

Continuous cropping with the same crop can lead to a build-up of soil-borne diseases, so a crop rotation is recommended. Zero tillage may result in an increased risk of diseases that are partially controlled by incorporating the stubble.

These operations are included in zero tillage crop production:

Fall

1. Trash management Straw and chaff must be removed or chopped and evenly distributed in the fall to allow for proper seed placement.

2. Weed Control Perennial weeds (quackgrass, Canada thistle and perennial sow thistle) and winter annual weeds (stinkweed, shepherd's purse, and flixweed) must be controlled in the fall.

3. Soil test A soil test is required to accurately determine fertility requirements.

Spring

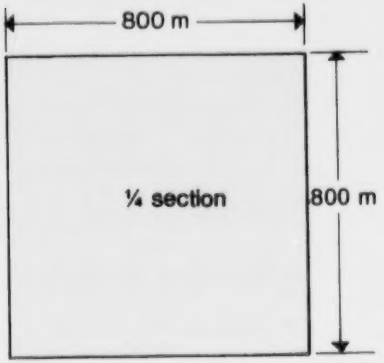
1. Fertility Fertilize zero tillage crops according to soil test recommendations. Place maximum allowable amounts with the seed with the remaining nitrogen being broadcast. Granular fertilizer is preferred to solution nitrogen for broadcast application, especially under dry conditions.

2. Seeding Seed should be placed 2 to 3 cm (0.8 to 1.2 inches) into moisture using a modified press drill or a commercial zero tillage drill. Minimize soil disturbance to avoid unnecessary weed germination.

3. Initial weed control All weed growth present at the time of seeding must be controlled. The herbicide can be applied prior to seeding or between seeding and crop emergence. Application before seeding eliminates the risk of weather delaying spraying past crop emergence. Application after seeding, but prior to crop emergence, maximizes weed control by allowing more weeds to emerge.

4. Weed control in the crop Selective weed control in the crop depends on postemergent herbicides. Crops which can not be treated with postemergent herbicides should not be considered for zero tillage.
Specific weed control recommendations can be obtained from the *Guide to Chemical Weed Control.*

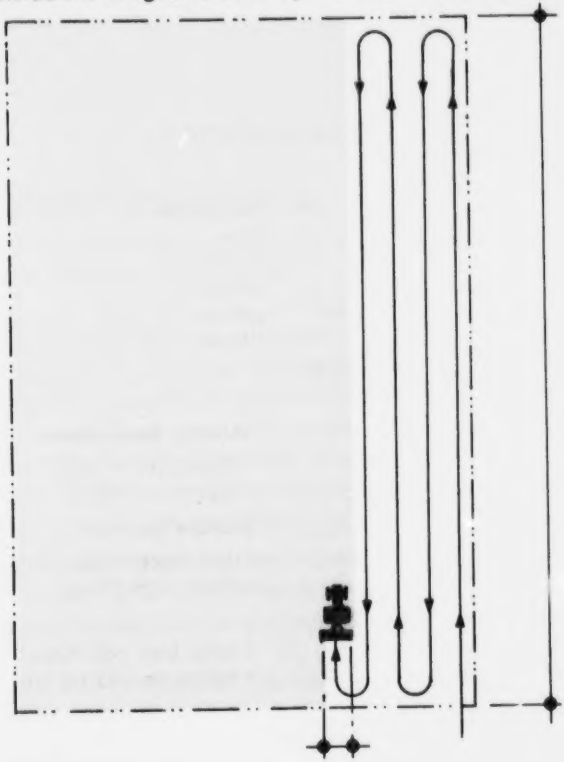
METRIC CALIBRATIONS



½ mile = 800 metres
¼ mile = 400 metres
⅛ mile = 200 metres
1 rod = 5 metres
1 foot = 0.3 metres

Procedure

1. Determine the working width of your seeder in metres (m).
2. Determine the length of your field in metres.
2. Multiply the width of the machine by the distance travelled. Divide by 10,000 to get the number of hectares covered.
4. Determine the amount of seed or fertilizer used in kilograms (kg).
5. Divide the kilograms used by the hectares covered to get kg/ha.



Example:

seed drill width — 5 metres
½ mile field — 4 passes = 4 x 800 m = 3200 m
120 kg of seed used

$$\frac{5 \text{ m} \times 3200 \text{ m}}{10{,}000} = 1.6 \text{ ha}$$

$$\text{seeding rate is } \frac{120 \text{ kg}}{1.6 \text{ ha}} = 75 \text{ kg/ha}$$

The procedure is the same for all seeds and fertilizers regardless of type or density.

The approximate weights of various seeds and fertilizers contained in a level full 20 litre pail are:

wheat	16-17 kg	rapeseed, mustard	13.5-14.5 kg
barley	13-14 kg	peas, beans	17-18 kg
oats	9-10 kg	sunflowers	6-6.5 kg
flax	14-15 kg	buckwheat	13 kg
rye	15-16 kg	granular fertilizer	20-21 kg

Application rates in lbs/acre can be converted to kg/ha by adding 10%. Example: 50 lbs/acre = 55 kg/ha.

METRIC CONVERSION FACTORS

SYMBOLS

kilometre	km	kilopascal	kPa
metre	m	litre	L
centimetre	cm	millilitre	mL
square metre	m^2	kilogram	kg
millimetre	mm	gram	g
hectare	ha	tonne	t
cubic metre	m^3		

Oats

1 bus/acre = 38.11 kg/ha
1 bus = 15.442 kg

Rapeseed, Mustard

1 bus/acre = 56.04 kg/ha
1 bus = 22.68 kg

Wheat, Peas, Beans, Clover

1 bus/acre = 67.25 kg/ha
1 bus = 27.22 kg

Barley, Buckwheat

1 bus/acre = 53.80 kg/ha
1 bus = 21.77 kg

Corn, Flax, Rye

1 bus/acre = 62.77 kg/ha
1 bus = 25.40 kg

1 Imp. bus = 0.0364 m^3
1 ton/acre = 2.24 t/ha

Approximate Average Bulk Densities

Wheat, peas, beans, clover	770 kg/m^3
Rye	730 kg/m^3
Corn	700 kg/m^3
Flax	650 kg/m^3
Rapeseed, mustard	640 kg/m^3
Barley	620 kg/m^3
Buckwheat	610 kg/m^3
Oats	470 kg/m^3
Sunflower Seed	290 kg/m^3

1 Imp. fl. oz. = 28.41 mL
1 Imp. fl. oz./acre = 70.21 mL/ha
1 oz = 28.35 g
1 lb/acre = 1.121 kg/ha
1 oz/acre = 70.06 g/ha
1 lb/in^2(psi) = 6.895 kPa
1 HP = 0.7457 kW

1 Imp. gal = 4.546 L
1 Imp. gal/acre = 11.23 L/ha
1 U.S. gal = 3.785 L
1 lb = 0.4536 kg
1 acre = 0.4047 ha
1 ft = 0.3048 m
1 in = 2.54 cm

10	mm	= 1 cm
100	cm	= 1 m
1000	m	= 1 km
10,000	m^2	= 1 ha

1000	mL	= 1L
1000	L	= 1 m^3
1000	g	= 1 kg
1000	kg	= 1 t

Related Publications

Additional information on field crop production can be obtained from the following publications:

Diseases of Field Crops in the Prairie Provinces Agriculture Canada Publication 1008, revised 1967.

Principles and Practices of Commercial Farming Faculty of Agriculture, The University of Manitoba; Fifth Edition 1977, $12.00.

Single page leaflets of common diseases may be obtained from: Manitoba Agriculture, Winnipeg, Manitoba.

Vegetable Crop Production Guide. Manitoba Agriculture. Annual.

Guide to Chemical Weed Control, Manitoba Agriculture. Annual.

Production guides for various crops, Manitoba Agriculture.

Crop Rotation Chart, Manitoba Agriculture.

Diseases of Special Crops and Vegetables wall chart, Manitoba Agriculture

Manitoba Soil Testing Services Manitoba Agriculture, Factsheet.

CEREAL CROPS

BARLEY

Varieties

FOR MALTING OR FEED: (blue aleurone)

Argyle	all zones	6-row
Bonanza	all zones	6-row
Conquest	all zones	6-row

FOR FEED: (yellow aleurone)

Bedford	all zones	6-row
Johnston	all zones	6-row
Klondike	all zones	6-row
Norbert	all zones	2-row
Summit	all zones	2-row

Argyle is a new six-rowed, blue-aleurone barley with excellent lodging resistance and high yielding ability. Laboratory tests have shown it to be promising in malting quality, and it is being assessed through large-scale processing by the malting and brewing industry. Seed of Argyle was released to SeCan in the spring of 1982.

NOTE:

1) Norbert:

a) Increase seeding rate by 25.0% to compensate for large kernel.

b) Crop tolerance problems to Hoe-Grass may occur; for herbicide recommendations for Norbert see the 1983 Guide to Chemical Weed Control.

2) Johnston and Summit:
May not be recommended in 1984.

3) Beacon:
Licensed in Canada and may be purchased by Canadian maltsters for export to the U.S.A.

Barley Variety Descriptions

								Resistance to:				
Variety	Yield as % of Bonanza	Days to Maturity	Height cm	Height (in)	Bulk Density kg/m³	Bulk Density (lb/bu)	Lodging	Stem Rust	Loose Smut	Surface borne Smuts	Root Rot	Leaf Diseases
Argyle	102	86	90	(36)	625	(48.5)	Excel.	Good	Fair	Poor	Fair	Good
Bedford	110	87	79	(32)	659	(51.2)	Excel.	Good	Fair	Fair	Fair	Good
Bonanza	100*	85	89	(36)	636	(49.4)	Fair	Good	Fair	Poor	Fair	Good
Conquest	92	84	93	(37)	631	(49.0)	Good	Good	Fair	Fair	Fair	Good
Johnston	103	90	86	(34)	639	(49.3)	Poor	Good	Fair	Poor	Fair	Good
Klondike	104	86	82	(33)	642	(49.9)	Fair	Good	Fair	Fair	Fair	Good
Norbert	105	87	80	(32)	671	(52.1)	Excel.	Good	Poor	Poor	Poor	Good
Summit	101	88	78	(31)	668	(51.9)	Excel.	Poor	Poor	Fair	Fair	Poor

*Average 67 station years of tests was 3775 kg/ha (70.2 bu/acre)

Seeding

Dates May 1 to May 31. On the average, highest barley yields are obtained when the crop is planted within two weeks after the land can be properly worked. Planting in late May or early June can result in significant yield reductions.

Rates 65 to 120 kg/ha (1.25 to 2.25 bu/acre). Circumstances requiring heavier rates of seeding include reduced germination, large seed size, abundant moisture reserves, and rough land preparation. The seeding rate for 2-rowed barley varieties should be increased 10 to 15 per cent because of kernel size.

Depth 4 to 5 cm (1.5 to 2 inches). Sow seed deep enough to reach moisture. Deep seeding weakens the plants and may result in poor emergence.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Place all phosphate, potash, and nitrogen when possible, in the seed row for most efficient use of the fertilizer. Total seed placed fertilizer should not exceed 195 kg/ha, (174 lb/acre). Up to 45 kg/ha, (40 lb/acre) nitrogen; not more than 20 kg/ha (18 lb/acre) nitrogen in urea form, may be placed with the seed. Urea or urea-P should not be placed with the seed on coarse textured soils nor with the seed on any soil under dry seedbed conditions. Place any additional fertilizer required away from the seed. When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)(1)		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
Barley to be grown on	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre
Fallow or legume breaking (2)	0-30	0-27	30-45	27-40	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	30-60	27-54	30-45	27-40	(3)	(3)	(4)	(4)
Stubble	60-100	54-89	30-45	27-40	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 15 to 35 kg/ha (13 to 31 lb/acre) of potash (K_2O).

(4) Low sulphur levels can occur in any Manitoba soil. For information on the application of different forms of sulphur fertilizer, see page 18.

Weed Control

For recommended herbicides see Table 3.

Disease Control

Smuts Treat seed of varieties listed as having fair resistance to loose or surface borne smuts (covered and false loose) with a suitable fungicide every three years. Varieties with poor resistance should be treated every two years. See Table 2.

Leaf spots Fungi which cause leaf spot diseases of barley overwinter on barley straw, stubble, and on seed. Treat seed from infected fields to reduce seedling infection. See Table 1 for more information.

Ergot If ergot has been a problem, rotate with a non-susceptible crop for one year to reduce disease incidence (see Table 1). Cultivate fields after harvest to bury ergot bodies to a depth of at least 5 cm (2 inches) and mow grass headlands and roadsides before heading to reduce ergot spread. If the seed source is known to contain ergot bodies, storage for more than one year reduces their viability to almost zero. Levels of ergot bodies in the harvested grain above 0.1 per cent may be toxic in livestock feed.

Harvesting

Particular care must be taken when harvesting malting barley, otherwise a promising standing crop of malting barley may end up in the feed grades. Give close attention to the following:

- To promote fast drying, swath in compact windrows laid on stubble about one-third the height of the standing crop. The head should not come in contact with the ground.

- Adjust the combine several times during the day if necessary to prevent cracking and peeling. This generally means a slower cylinder speed than used for wheat, oats, or feed barley. Have the concave clearance adjusted to suit conditions; wider clearances are usually required at midday when the grain is driest.

- Avoid using damaged grain augers and elevators which can cause broken and peeled kernels.

- Highest yields are obtained when swathing is done with a kernel moisture content of about 35 per cent. Then the kernels are firm but easily dented with the thumb nail.

OATS

Varieties

Dumont	all zones	see comments
Fidler	all zones	

Dumont is a newly licensed, late maturing variety with excellent rust and smut resistance. It has large very plump kernels and yields have been about eight percent above Fidler. Straw strength is only fair. Seed was released to SeCan in the spring of 1982 and should be available in limited quantities in the fall of 1983.

Variety Description

Variety	Yield as % of Fidler	Relative Maturity	Height cm (in)	% Hull	Resistance to: Lodging	Stem Rust	Leaf Rust	Smut
Dumont	108	103	92 (36)	Low	Fair	Good	Good	Good
Fidler	100*	100	86 (34)	Medium	Good	Good	Good	Good

*Average 31 station years — All Manitoba — 3855 kg/ha (101.2 bus/acre)

Seeding

Dates May 1 to May 31. Oats give best returns when sown early in May.

Rates 55 to 115 kg/ha (1.5 to 3 bu/acre). Conditions favoring heavier rates of seeding are large seed size, low germination, late seeding, weeds, wireworms, abundant moisture reserves, heavy textured soils, high soil fertility, deep seeding, and rough seedbed.

Depth 4 to 7 cm (1.5 to 3 inches).

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Place all phosphate, potash and nitrogen when possible, in the seed row for most efficient use of the fertilizer. Total seed-placed fertilizer should not exceed 195 kg/ha (174 lb/acre). Up to 45 kg/ha (40 lb/acre) nitrogen; not more than 20 kg/ha (18 lb/acre) nitrogen in urea form, may be placed with the seed. Urea or urea-P should not be placed with the seed on coarse textured soils nor with the seed on any soil under dry seedbed conditions. Place any additional fertilizer required away from the seed. When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

Oats to be grown on	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)[1]		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre
Fallow or legume breaking (2)	0-30	0-27	30-45	27-40	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	30-60	27-54	30-45	27-40	(3)	(3)	(4)	(4)
Stubble	60-100	54-89	30-45	27-40	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 15 to 35 kg/ha (13 to 31 lb/acre) of potash (K_2O).

(4) Low sulphur levels can occur in any Manitoba soil. For information on the application of different forms of sulphur fertilizer, see page 18.

Weed Control

For recommended herbicides see Table 3.
Note: Avoid seeding oats in fields treated in the previous year with Treflan or Avadex BW.

Disease Control

Early seeding of oats will prevent or reduce damage by barley yellow dwarf virus.

Harvesting

Highest yields are obtained by swathing when the kernel moisture content is about 35 per cent. The greenest kernels (groats) at this stage have just changed from green to cream coloured. To obtain highest milling grades, dehulled kernels must be avoided. This may involve slower cylinder speed and wider concave clearances.

RYE

Varieties

FALL RYE

Cougar	all zones
Musketeer	all zones
Puma	all zones

SPRING RYE

Gazelle	all zones

Musketeer was licensed in 1980. Seed will be in short supply for 1983. Musketeer is higher yielding than Cougar and Puma. Winter hardiness is considered to be equal to Puma and Cougar.

***NOTE:** Cougar may be taken off the recommended list in 1984.*

Variety Description

Variety (fall)	Yield as % of Puma	Order of Maturity	Winter Survival	Resistance to: Lodging	Shattering	Ergot
Cougar	88	3	Fair	Very Good	Good	Poor
Musketeer	104	1	Very Good	Good	Good	Poor
Puma	100	2	Very Good	Fair	Fair	Fair
Variety (spring)						
Gazelle	80	—	—	Fair	Good	Poor

*Average 15 station years all Manitoba.

Seeding

Dates Fall Rye - August 25 to September 15
Spring Rye - May 1 to May 30

Rates 45 to 95 kg/ha (0.75 to 1.5 bu/acre). High rates of seeding should be used with larger seed size, poor germination, weed competition, and poor seedbed conditions.

Depth 2.5 to 5 cm (1 to 2 inches). Do not plant rye deeper than necessary to assure contact with moist soil. Deeper seeding may result in decreased emergence and weak plants causing severe winter kill in fall-seeded varieties.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Place all phosphate, potash, and nitrogen when possible, in the seed row for most efficient use of the fertilizer. Total seed-placed fertilizer should not exceed 195 kg/ha (174 lb/acre). Up to 45 kg/ha (40 lb/acre) nitrogen; not more than 20 kg/ha (18 lb/acre) nitrogen in urea form, may be placed with the seed. Rates of nitrogen above those that can be safely applied with the seed should be broadcast in the spring. Urea or urea-P should not be placed with the seed on coarse textured soils or with seed on any soil under dry seedbed conditions. Place any additional fertilizer required away from the seed. When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)[1]		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
Rye to be grown on	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre
Fallow or legume breaking (2)	0-20	0-18	30-45	27-40	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	20-45	18-40	30-45	27-40	(3)	(3)	(4)	(4)
Stubble	45-70	40-62	30-45	27-40	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast in the spring. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 15 to 35 kg/ha (13 to 31 lb/acre) of potash (K_2O).

(4) Low sulphur levels can occur in any Manitoba soil. For information on the application of different forms of sulphur fertilizer, see page 18.

Weed Control

For recommended herbicides see Table 3.
Avoid seeding fall rye in fields treated in the seeding year with Treflan.

Disease Control

Seed Rot and Seedling Blights Rye seed should be treated with a suitable treatment product to reduce seed rot, seedling blights and stem smut. See Table 2 for additional information.

Ergot For ergot problems, rotate with a non-susceptible crop for one year to reduce incidence (see Table 1). Cultivate fields following harvest to bury ergot bodies to a depth of at least 5 cm (2 inches) and mow grass headlands and roadsides before heading to reduce spread. If the seed source is known to contain ergot bodies, storage for more than one year will reduce their viability to almost zero. Levels of ergot bodies in the harvested grain above 0.1 per cent may be toxic in livestock feed.

TRITICALE

Varieties

Carman	all zones
Welsh	all zones

Triticale yield and protein content are about equal to that of Glenlea wheat. The main uses of triticale, at the present time, in Canada, are as a food for human consumption and as a livestock feed.

Variety Description

Variety	Yield % of Glenlea	Maturity	Lodging	Resistance to: Stem rust	Leaf rust	Loose smut
Carman	101	3-5 days later than Glenlea	Good	Good	Fair	Fair
Welsh	98	comparable to Glenlea	Good	Good	Fair	Fair

*Glenlea yield - 3294 kg/ha (48.9 bu/acre)

Seeding

Dates April 15 to May 15. Triticale must be sown as early as possible for maximum yields.

Rates 110 kg/ha - 150 kg/ha (2 to 3 bu/acre) depending on seed size.

Depth 5 cm (2 inches). Triticale should not be planted deeper than necessary to assure contact with moist soil. Decreased emergence and weaker plants may result from deeper seeding.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Place all phosphate, potash, and nitrogen when possible, in the seed row for most efficient use of the fertilizer. Total amount of seed-placed fertilizer should not exceed 195 kg/ha (174 lb/acre). Up to 45 kg/ha (40 lb/acre) nitrogen; not more than 20 kg/ha (18 lb/acre) nitrogen in urea form, may be placed with the seed.

Do not place urea or urea-P with the seed on coarse textured soils nor with the seed on any soil under dry seedbed conditions. Place any additional fertilizer required away from the seed.

When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)[1]		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
Triticale to be grown on	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre
Fallow or legume breaking (2)	0-20	0-18	30-45	27-40	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	20-45	18-40	30-45	27-40	(3)	(3)	(4)	(4)
Stubble	45-70	40-62	30-45	27-40	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 15 to 35 kg/ha (13 to 31 lb/acre) of potash (K_2O).

(4) Low sulphur levels can occur in any Manitoba soils. For information on the application of different forms of sulphur fertilizer, see page 18.

Weed Control

For recommended herbicides see Table 3.

Disease Control

Ergot Triticale is slightly more susceptible to ergot than wheat. If this is a problem, rotate with a non-susceptible crop for one year to reduce incidence (see Table 1). Cultivate fields following harvest to bury ergot bodies at least 5 cm (2 inches). Mow grass headlands and roadsides before heading to reduce spread. If the seed source contains ergot bodies, storage for more than one year reduces their viability to almost zero. Ergot body levels in the harvested grain above 0.1 per cent may be toxic in livestock feed.

Special Notes

Triticale is a new crop species still limited in its adaptation. Growers are advised to test it initially on a small scale before seeding larger acreages. Grain grades have now been established to facilitate marketing.

Triticale is more susceptible to sprouting in the swath than varieties of Hard Red Spring Wheat. Straight combining is advisable since it has been successful in minimizing sprouting damage.

WHEAT

VARIETIES

Eligible for Canada Western Red Spring grades

Benito	all zones	
Columbus	all zones	see comments
Katepwa	west of Highway 10 up to and including zone 5	see comments
Neepawa	west of Highway 10 up to and including zone 5	see comments
Sinton	all zones	

Eligible for Canada Utility grades

Glenlea	all zones

Eligible for Canada Western Amber Durum grades

Coulter	all zones
Medora	all zones
Wakooma	all zones

Columbus is late maturing and is not recommended in areas where early frost may be a problem. It is the first recommended variety to incorporate considerable resistance to harvest time sprouting.

Katepwa was licensed in 1981 and is under the control of SeCan Association. Although more resistant to leaf rust than Neepawa, neither variety has enough resistance to be recommended east of Highway 10.

Medora is a newly licensed high yielding, strong-strawed variety. Seed will be distributed by SeCan, but certified seed will not be available until fall, 1983.

Variety Description

Variety	Yield as % of Neepawa	Relative Maturity	Seed Size	Height	Lodging	Resistance to: Stem Rust	Leaf Rust	Loose Smut	Bunt
Benito	99	99	Small	Medium	Good	Good	V. Good	Good	Fair
Columbus	100	104	Medium	Medium +	Excellent	Fair	Good	Fair	Good
Katepwa	106	100	Medium	Medium	Excellent	Good	Fair	Good	Good
Neepawa	100*	100	Medium	Medium	Excellent	Good	Poor	Good	Fair
Sinton	101	102	Medium	Medium	Excellent	Good	Good	Poor	Fair
Glenlea	117	104	Large	Medium +	Excellent	Good	V. Good	Good	Fair
Coulter	111	102	Large	Medium	Fair-Good	Good	V. Good	Fair	Good
Medora	114	103	Large	Medium +	Fair-Good	Good	V. Good	Fair	Good
Wakooma	105	105	Large	Medium +	Fair	Good	V. Good	Fair	Good

*Average 67 station-years — all Manitoba — 2672 kg/ha (42 bu/acre).

Seeding

Dates May 1 to May 31. Start seeding as early in spring as soil conditions permit. Any delay may result in lower yields.

Rates 65 to 135 kg/ha (1 to 2 bu/acre). Conditions favouring heavier rates of seeding are large seed size, low germination, late seeding, weeds, wireworms, abundant moisture, heavy textured soils, high fertility, deep seeding, and rough seedbed. Durum wheat should be seeded at the higher rate because of its large seed size.

Depth 4 to 8 cm (1.5 to 3 inches). Plant seeds only deep enough

to reach moisture. Deep seeding weakens the plants and may result in poor emergence and lower yields.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Place all phosphate, potash, and nitrogen when possible, in the seed row for most efficient use of the fertilizer. Total seed-placed fertilizer should not exceed 195 kg/ha (174 lb/acre). Up to 45 kg/ha (40 lb/acre) nitrogen; not more than 20 kg/ha (18 lb/acre) nitrogen in urea form, may be placed with the seed.

Urea or urea-P should not be placed with the seed on coarse textured soils nor with the seed on any soil under dry seedbed conditions. Place any additional fertilizer required away from the seed. When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)(1)		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
Wheat to be grown on	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre
Fallow or legume breaking (2)	0-30	0-27	30-45	27-40	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	30-60	27-54	30-45	27-40	(3)	(3)	(4)	(4)
Stubble	60-100	54-89	30-45	27-40	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 15 to 35 kg/ha (13 to 31 lb/acre) of potash (K_2O).

(4) Low sulphur levels can occur in any Manitoba soil. For information on the application of different forms of sulphur fertilizer, see page 18.

Nitrogen Fertilization and Protein Content High protein wheat can be grown in all areas of Manitoba if sufficient nitrogen is available to the plant from the soil or from nitrogen applied as fertilizer. As the nitrogen supply is increased from low to high, an increase in yield first results and is followed by an increase in both yield and protein content. Wheat protein content is about 13.2 to 13.5 per cent when sufficient nitrogen is present for near maximum yields. To determine if sufficient nitrogen is present for near maximum yields check the grains protein content. If protein content is less than 13.2 per cent, insufficient nitrogen has been added. When the protein content is more than 13.5 per cent, sufficient nitrogen has been added for near maximum yields.

The following table provides guidelines for the amounts of nitrogen fertilizer required to produce wheat of a particular protein content. Average values for soil-available nitrogen are used.

NITROGEN FERTILIZER REQUIRED kg N/ha (lb N/acre)
"Target" Protein Content (%) (1)

	12.5		13.5		14.5	
Wheat Grown On	**Area A[3]**	**Area B[4]**	**Area A**	**Area B**	**Area A**	**Area B**
Fallow or legume breaking (2)	0(0)	0(0)	0(0)	0(0)	30(27)	10(9)
Grass and grass-legume breaking (2)	20(18)	0(0)	60(54)	30(27)	100(89)	80(71)
Stubble	60(54)	35(31)	100(89)	70(62)	140(125)	120(107)

(1) Refers to protein content of Red Spring Wheats.

(2) Refers to breaking after first cut of forage (before June 30).

(3) Area A refers to Zones 3, 3A, 4 and 6.

(4) Area B refers to Zones 1, 2, 2A and 5.

Weed Control

For recommended herbicides see Table 3.

Disease Control

Loose Smut or Bunt Seed of varieties having fair resistance to loose smut or bunt should be treated with a suitable fungicide every three years. Those with poor resistance every two years. See Table 2.

Ergot If ergot has been a problem, rotate with a non-susceptible crop for one year to reduce incidence (see Table 1). Cultivate fields following harvest to bury ergot bodies to a depth of at least 5 cm (2 inches) and mow grass headlands and roadsides before heading to reduce spread. A seed source known to contain ergot bodies should be stored for more than one year to reduce viability to almost zero. Levels of ergot bodies in harvested grain above 0.1 per cent may be toxic in livestock feed.

Harvesting

Experiments show that highest yields are obtained by swathing when the kernel moisture content is about 35 per cent, and that there is no loss in quality, test weight, or seed size. This stage is reached when the kernels are firm but easily dented by the thumb nail. Greenest kernels should show a slight colour change towards yellow or brown.

WINTER WHEAT

All licensed varieties lack sufficient hardiness for conventional production in Manitoba. Direct planting into standing stubble provides a snow trap that improves winter survival. Currently licensed varieties are very susceptible to leaf and stem rust. Northstar is the hardiest variety available.

Management Practices

Winter wheat production in Manitoba requires that plants are protected from cold winter temperatures. The most effective method of protection is to use zero tillage.

The winter wheat is planted directly into the standing stubble of the previous crop. The standing stubble traps snow on the field which will then act as an insulating blanket to prevent cold temperature killing of winter wheat. The crop preceding winter wheat must provide upright stubble and must be harvested early to allow winter wheat to be planted on time. Barley, canola (particularly Polish types), oats, flax and buckwheat stubble can be used.

The stubble from the previous crop should be cut at a height of 20-30 cm (8 to 12 inches) to ensure at least 15 cm (6 inches) of snow cover can be maintained. Straw and chaff should be finely chopped and spread uniformly over the field. Subsequent harrowing may be necessary to ensure heavy residues do not interfere with seeding and seedling emergence. Seeding should be done with a zero till drill, although hoe drills and air seeders with row spacings 20 cm (8 inches) or less, equipped with narrow points (2 cm, 0.75 inch, or less), have performed satisfactorily.

Seeding

Dates: August 20 to September 15. Optimum date for southern areas of Manitoba is the 1st week of September, and the last week of August for northern areas. Winter wheat should be planted early enough to ensure that plants have 3 to 4 leaves at freeze-up. Delays in seeding cause late maturity, poor competition with weeds and lower yields.

Rates: 70 to 100 kg/ha (63 to 89 lb/acre). Conditions requiring heavier seeding rates are low germination, late seeding, heavy textured soils, deep seeding, poor drill penetration, abundant moisture, or high fertility.

Depth: 2.5 to 4 cm (1 to 1.5 inches). Winter wheat should be seeded shallow. Deep seeding late in the season causes a delay in emergence which may result in a poor stand.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Adequate fertility levels are required for optimum winter survival and yield of winter wheat. Although little information on fertilizer rates in zero-till winter wheat has been collected in Manitoba, the yield potential of the crop and information from other areas suggests that winter wheat should produce yield responses to fertilizer rates slightly higher than those used for spring wheat.

All phosphorous should be placed with the seed, for optimum efficiency and promotion of winter survival. If the soil nitrogen level is very

low, a small amount of nitrogen fertilizer could be applied at the time of seeding to encourage adequate growth in the fall and spring. Application of the bulk of fertilizer should be delayed until early spring, since fall application could lead to decreased nitrogen use efficiency. However, fall banded application of nitrogen may be a relatively efficient application method. If fall nitrogen fertilization is practiced, phosphorus fertility should be maintained at high levels to ensure adequate over wintering. For optimum efficiency, spring nitrogen should be applied prior to the resumption of winter wheat growth.

Sands, sandy loam and organic soils are often low in available potassium. Low sulfur levels can occur in any Manitoba soil. For highest yields, soil test and supply the stand with a balanced fertility supply.

Weed Control

See the Guide to Chemical Weed Control for weed control recommendations.

Disease Control

Follow a crop rotation of at least one year between wheat crops. Avoid other cereal crops in the rotation, to control soil borne diseases.

Loose Smut or Bunt Seed of varieties having fair resistance to loose smut or bunt should be treated with a suitable fungicide every three years. Those with poor resistance every two years. See Table 2.

Ergot If ergot has been a problem, rotate with a non-susceptible crop for one year to reduce incidence. Cultivate fields following harvest to bury ergot bodies to a depth of at least 5 cm (2 inches) and mow grass headlands and roadsides before heading to reduce spread. A seed source known to contain ergot bodies should be stored for more than one year to reduce viability to almost zero. Levels of ergot bodies in harvested grain above 0.1 per cent may be toxic in livestock feed.

Rust All varieties of winter wheat are susceptible to stem and leaf rust. In some years severe losses may occur due to rust infection. There are presently no fungicides registered for control of rust on wheat.

Tan Spot Winter wheat should not be planted into wheat stubble because of the risk of tan spot which may affect plants the following spring and throughout the season during periods of moist weather.

Special Notes

Zero tillage provides the most reliable method of winter wheat production in Manitoba but it is possible to grow winter wheat on summerfallow if a uniform snow cover is maintained. To achieve this snow cover, plant a nurse crop such as flax in the first week of August (seeding rate of 10 to 15 kg/ha, 9 to 13 lb/acre). The nurse crop will grow to a sufficient height that uniform snow trapping is possible. Winter wheat should be seeded in a second operation in early September.

OILSEEDS AND SPECIAL CROPS

BUCKWHEAT

Varieties

Large Seeded

Mancan	all zones	see special note
Manor	all zones	see special note

Small Seeded

Tempest	all zones	see special note
Tokyo	all zones	see special note

NOTE: *The variety Tempest may be removed from the recommended list for 1984.*

Variety Description

Variety	Yield as % of Tokyo	Days to 100% Bloom	Height cm	Height (inches)	Seed Weight g/1000
Mancan	91	44	111	(44)	29.0
Manor	98	43	111	(44)	28.1
Tempest	92	41	114	(45)	20.8
Tokyo	100*	40	110	(43)	22.7

*Average 44 station years — Manitoba cooperative and adaptation tests, 1976-82, — 1866 kg/ha (1665 lbs/acre)

Seeding

Dates: June 1 to June 25 (see Special Note)

Rate: 40 to 55 kg/ha (3/4 to 1 bu/acre)

Depth: 4 to 6 cm (1.5 to 2.5 inches)

Fertilizer

For specific recommendations, have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Any nitrogen in excess of 7 kg/ha (6 lb/acre) and phosphorus in excess of 20 kg/ha (18 lb/acre) and all potash and sulphur should be placed away from the seed to avoid seed injury. When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)(1)		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
Buckwheat to be grown on	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre
Fallow or legume breaking (2)	0-20	0-18	(3)	(3)	(4)	(4)	(5)	(5)
Grass and grass-legume breaking (2)	20-45	18-40	(3)	(3)	(4)	(4)	(5)	(5)
Stubble	45-70	40-62	(3)	(3)	(4)	(4)	(5)	(5)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) 30 to 45 kg/ha (27 to 40 lb/acre) of P_2O_5) about 2.5 cm (1 inch) to the side and 2.5 cm (1 inch) below the seed is recommended. No more than 20 kg/ha (18 lb/acre) should be placed with the seed.

(4) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 35 to 70 kg/ha (31 to 62 lb/acre) of potash (K_2O).

(5) Low sulphur levels can occur in any Manitoba soil. For information on the application of different forms of sulphur fertilizer, see page 18

Weed Control

For recommended herbicides see Table 3.

Harvesting

Swath buckwheat when about 75 percent of the seeds have turned brown. In the event of light frost, leave until the normal percent of seeds have turned brown. If severe frost occurs and stems are frozen, swath promptly to reduce loss from shattering. When combining, a cylinder speed of 600 to 800 revolutions per minute may be used as an initial setting.

Special Notes

Buckwheat is susceptible to late spring and early fall frosts which can cause significant yield reductions. To obtain maximum yields, especially of Mancan, plant before June 10. Northern plantings should be no later than June 15 to avoid early fall frosts. Buckwheat is a naturally cross-pollinated crop with insects being the main pollinating agents. Increases in yield are usually achieved by establishing colonies of bees near fields of buckwheat.

CANARYSEED

Canaryseed is the main ingredient of bird food mixtures for caged and wild birds. Generally, it is grown under contract with the contracting agency supplying the seed. No licensed varieties are currently available in Manitoba.

Canaryseed is an annual grass requiring about the same time to mature as wheat. Early May planting is recommended for maximum yield. A seeding rate of 40 kg/ha (35 lb/acre) is recommended, at a planting depth of 3.5 to 5 cm (1.5 to 2 inches). Planting on summerfallow has provided the highest yields, but establishment on well prepared stubble fields that are reasonably free of weeds has also given satisfactory results.

Canaryseed fertility needs can be determined by soil test. If soil analysis results are not available, the higher rates recommended for cereal crops may be used. Canaryseed is resistant to shattering and may be direct combined or swathed when fully mature. Additional information may be obtained from the publication *Canary Grass Seed Production in Manitoba, (Agdex 147)*, prepared by Manitoba Agriculture, and from the contracting agencies.
For recommended herbicides see Table 3.

CANOLA - RAPESEED

Varieties — all canola type — (all low erucic, low glucosinolate)

Argentine type *(Brassica napus)*

Altex	all zones
Andor	all zones
Regent	all zones
Westar	all zones

Polish type *(Brassica campestris)*

Candle	all zones
Tobin	all zones

Westar is a new variety of summer canola (Argentine type) developed at the Agriculture Canada Research Station, Saskatoon, and licensed in 1982. Westar was developed from crosses involving several breeding lines Midas and Tower. Westar represents a major improvement in seed yield, and is quite similar to Altex and Andor in most other characteristics but has superior lodging resistance similar to that of Regent. Breeders and Foundation seed are available in 1983 but certified seed will not be available until 1984. Seed stocks of Westar are distributed through SeCan. The Canadian oilseed crushing industry now processes only seed from canola (low erucic, low glucosinolate) varieties. Importers in other countries are also developing a preference for canola. As a result of this trend, 90% of the 1982 rapeseed acreage in western Canada was seeded with canola varieties. It is recommended that producers use only certified seed of the recommended canola varieties to assure acceptability of their product.

Limited production of high erucic acid rapeseed varieties (Reston and R-500) for industrial markets is continuing. These varieties are grown on a contract basis only.

Variety Description

Species and Variety	Yield* kg/ha	Yield* lb/acre	Days to Maturity**	Height cm	Height (in)	Seed Oil*** (%)	Meal Protein*** (%)
Argentine *(B. napus)*							
Altex	1816	1620	95	101	40	42.3	47.0
Andor	1908	1702	95	104	41	42.6	46.6
Regent	1773	1582	96	106	42	42.2	47.7
Westar	2073	1849	95	102	40	42.9	46.7
Polish *(B. campestris)*							
Candle	1524	1360	82	96	38	42.0	43.1
Tobin	1529	1364	81	97	38	42.5	43.2

* Average of 26 Tests in Manitoba (Co-operative Tests 1980-82; Regional Adaptation Trails 1982).
** Co-operative Tests in Manitoba (1980-82).
*** Co-operative Tests in Western Canada (1980-81). Dry weight basis.

Seeding

Dates Argentine type - May 5 to May 30
Polish type - May 5 to June 15

Canola should be sown early for uniform ripening, better grade and higher yield. The Argentine type varieties are later maturing and represent a greater risk if grown in areas with a short frost free season. The Polish type varieties are lower yielding but mature earlier and are less likely to sustain frost damage in short-season areas or if seeding is delayed.

Rates Argentine type - 6 to 8 kg/ha (5 to 7 lb/acre)
Polish type - 5 to 7 kg/ha (4 to 6 lb/acre)

Depth 2.5 to 4 cm (1 to 1.5 inches)

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Any nitrogen in excess of 7 kg/ha (6 lb/acre) and phosphorus in excess of 20 kg/ha (18 lb/acre) and all potash and sulphur should be placed away from the seed to avoid seed injury. When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

	RATE OF NUTRIENT TO ADD							
Canola-Rapeseed to be grown on	Nitrogen (N)(1) kg/ha	Nitrogen (N)(1) lb/acre	Phosphate (P_2O_5) kg/ha	Phosphate (P_2O_5) lb/acre	Potash (K_2O) kg/ha	Potash (K_2O) lb/acre	Sulphur (S) kg/ha	Sulphur (S) lb/acre
Fallow or legume breaking (2)	0-35	0-31	(3)	(3)	(4)	(4)	(5)	(5)
Grass and grass-legume breaking (2)	35-80	31-71	(3)	(3)	(4)	(4)	(5)	(5)
Stubble	80-100	71-89	(3)	(3)	(4)	(4)	(5)	(5)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) 30 to 45 kg/ha (27 to 40 lb/acre) of P_2O_5 as a sideband application about 2.5 cm (1 inch) to the side and 2.5 cm (1 inch) below the seed is recommended. No more than 20 kg/ha (18 lb/acre) should be placed with the seed.

(4) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 35 to 70 kg/ha (31 to 62 lb/acre) of potash (K_2O).

(5) Twenty kg/ha (18 lb/acre) of sulphur (S) are recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. For information on the application of different forms of sulphur fertilizer see page 18.

Weed Control

Perennial sow thistle and Canada thistle cannot be effectively controlled in canola or rapeseed. Research has shown that herbicides such as 2,4-D, MCPA and Banvel cause significant crop injury and yield reduction. Plant canola or rapeseed on fields free of perennial thistles. If thistle growth develops in these fields consider after-harvest spraying and selective control in the following crop. For recommended herbicides see Table 3.

Disease Control

Use seed from disease free fields. Treat seed to control seed rot, seedling blights and black leg. (See Table 2.) To control soil-borne diseases follow a crop rotation of at least four years. Avoid fababeans, field beans, field peas, lentils, mustard, soybeans and sunflowers in the rotation because of Sclerotinia stem rot, (see Table 2). If necessary, Sclerotinia stem rot may be controlled by aerial application of benomyl (Benlate 1.0-1.5 kg/ha (0.9-1.4 lb/acre) at the 20-30 per cent blossom stage. Argentine types are resistant to staghead. Do not sow canola or rapeseed adjacent to canola or rapeseed stubble, and control volunteer seedlings early in the season. For further information see the section Disease Control.

Insect Control

Flea beetles can damage canola and rapeseed crops from early seedling to harvest. Seed treatments with furadan or lindane are strongly recommended. Observations throughout the entire growing season are necessary to determine if post-emergence sprays are needed. For recommended insecticides see Table 4.

The Bertha army worm has been a serious pest in canola and rapeseed fields in Manitoba. When its numbers exceed 10 to 12/square metre, control measures should be considered. For control recommendations see Table 4, and the publication *Insect Control on Field Crops*.

Desiccation

Desiccation may be used to chemically accelerate plant drying. It does not speed crop maturity but will reduce the time from maturity to harvest. The *Guide to Chemical Weed Control* contains specific recommendations.

Harvesting

Swathing may begin when 25 per cent of the seeds have reached a mature color. At this stage, most of the remaining seeds may be greenish-red, and some still completely green.

Storage

Canola or rapeseed requires careful storage. It can sweat for up to six weeks after storage, resulting in spoilage and heating. This is known to occur even at nine to ten per cent moisture content, particularly when binned on very hot days. If the moisture content is over 8.5 per cent it should be examined for spoilage and heating at intervals *within* the bulk.

Higher moisture content canola or rapeseed requires more frequent inspection. If detected, spoilage and heating can be reduced by turning. Use a deflector within the bin to spread heavier immature material away from the centre as it is more prone to heating.

FABABEANS

Varieties

Ackerperle	all zones
Aladin	all zones
Diana	all zones
Herz Freya	all zones
Outlook	all zones

Fababeans are an annual legume grown for export as food and for on farm feed sources. They require a long growing season but are spring frost tolerant and so must be sown early. When seeding, take care to avoid seed damage in the seeding mechanism. Seeds with a cracked seed coat will not germinate. If cracking occurs, increase the seeding rate to compensate for the loss. Seed treatment with the specific inoculum is essential.

Outlook, licensed in 1982, was developed by the University of Saskatchewan. It is higher in yield than Ackerperle, Diana and Herz Freya. Seed is distributed through SeCan.

Variety Description

Variety	Yield as % of Ackerperle	Seed Weight g/1000	Days to Maturity Average	Days to Maturity Range	Protein Content (%)
Ackerperle	100[1]	376	112	104-120	30.2
Aladin	109	430	112	105-119	30.2
Diana	106	412	104	101-106	31.6
Herz Freya	107	423	102	100-103	29.6
Outlook	108	397	111	101-119	30.2

[1]Average of 24 station years, 1979-1982, 3800 kg/ha (3390 lb/acre).

Seeding

Dates April 25 to May 15. Seeding should start once soil conditions permit. Late planting results in delayed maturity and extreme frost hazard.

Rates 135 to 200 kg/ha (120 to 180 lb/acre). Large seeded varieties require the higher rates.

Depth 6 to 10 cm (2.5 to 4 inches). Fababeans are slow to emerge and must be in contact with moisture until well established.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Nitrogen is not recommended. Phosphorus is recommended at 30 to 45 kg/ha (27 to 40 lb/acre) P_2O_5 as a sideband application.

If applied with the seed the maximum rate of P_2O_5 recommended is 20 kg/ha (18 lb/acre). Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 35 to 70 kg/ha (31 to 62 lb/acre) potash (K_2O). Place potassium away from the seed.

Twenty kg/ha (18 lb/acre) sulphur (S) is recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. For information on the application of different forms of sulphur fertilizer see page 18.

Weed Control

For recommended herbicides see Table 3.

Disease Control

Fababeans are susceptible to a number of diseases which attack other broad-leaved crops. Use of seed tested for diseases is strongly recommended to avoid losses from seed borne Ascochyta blight. Follow a crop rotation of at least four years between successive crops of fababeans to control Ascochyta and other soil borne diseases. Because of Sclerotinia disease, field beans, field peas, lentils, mustard, canola, rapeseed, soybeans and sunflowers should be avoided in the rotation. For further information on Sclerotinia Disease, see the section *Disease Control* and Table 1.

Harvesting

Begin swathing when 10 to 20 per cent of the pods have darkened. Reduced cylinder speed and maximum concave clearance will minimize seed damage.

FIELD BEANS

Varieties	*Type*	
Loop	Black	South of township 14. Zones 1,
Seafarer	Navy	2, 2A, 3 & 3A.

Variety Description

Type	Variety	Yield % of Seafarer	Seed Weight g/1000	Maturity Range In Days	Height cm	(in)
Black	Loop	110	210	110-128	47	(18)
Navy	Seafarer	100*	224	95-105	38	(15)

*Average of 18 station years, 1979-82, Manitoba Co-operative and Adaptation Trials — 1892 kg/ha (1688 lb/acre).

Seeding

Field beans are easily damaged by spring and fall frosts, so early and late seeding should be avoided. Innoculate seed with the recommended nodule forming bacterium.

Dates Navy Beans - May 24 to June 1
Black Beans - May 20 to May 27
Pinto Beans - May 20 to May 27

Rates: Navy Beans - 45 kg/ha (40 lb/acre)
Black Beans - 45 - 55 kg/ha (40 - 49 lb/acre)
Pinto Beans - 60 - 70 kg/ha (54 - 62 lb/acre)

Depth 4 to 6 cm (1.5 to 2.5 inches)

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Nitrogen is not recommended for any bean crops. Phosphorus is not recommended for black beans. For other field beans apply 30 to 45 kg/ha (27 to 40 lb/acre) P_2O_5 as a sideband application. If applied with the seed the maximum rate of P_2O_5 recommended is 20 kg/ha (18 lb/acre). Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 35 to 70 kg/ha (31 to 62 lb/acre) potash (K_2O). Place potassium away from the seed.

20 kg/ha (18 lb/acre) sulphur (S) is recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. For information on the application of different forms of sulphur fertilizer see page 18.

Weed Control

For recommended herbicides see Table 3.

Desiccation

Desiccation may be used to chemically accelerate plant drying. It does not speed crop maturity but will reduce the time from maturity to harvest. Check the annual *Guide to Chemical Weed Control* for specific recommendations.

Disease Control

Bacterial Blight Use pedigreed seed or seed known to be free from bacterial blight. Apply tribasic copper sulphate (Tri cop) or cupric hydroxide (Kocide 101) at 1.1 to 3.3 kg/ha (1 to 3 lb/acre) at first sign of disease. Do not apply within one day of harvest. Chemical control may not be practical except for small seed plots or other special situations. Avoid working fields when leaves are wet.

Bean Rust Heavy infection of rust reduces yield particularily of pinto beans. After harvest turn under all bean refuse as completely as possible.

Sclerotinia Disease (white mold) Avoid fababeans, field peas, lentils, mustard, canola, rapeseed, soybeans and sunflowers in the rotation. 'Any of the following chemicals may be applied as a protectant treatment: benomyl (Benlate 50WP) at 2.2 kg/ha (2 lb/acre); chlorothalonil (Bravo 75WP) 3.3 kg/ha (3 lb/acre) or (Bravo 6F) at 4.25 L/ha (3 pints/acre); thiophanate methyl (Easout 70WP) at 2.2 kg/ha (2 lb/acre); iprodione (Rovral 50WP) at 2 kg/ha (1.9 lb/acre). These fungicides should be applied at specific flowering times and for details of the precise timing of application see the label of the particular chemical.' Thorough coverage of blossoms is essential. Do not apply any of these chemicals within 14 days of harvest. Avoid dense foliage favorable for disease development by restricting nitrogen. Follow a crop rotation of four years to control Sclerotinia and other soil-borne diseases.

For further information, see the *Disease Control* section and Table 1.

Special Notes

Field beans are sensitive to certain herbicide residues such as atrazine. Extreme care must be used in applying herbicides to any crop that is to precede a bean crop. A row spacing of 60 to 70 cm (24 to 28 inches) is advisable, particularly if specialized bean equipment is being used.

FIELD PEAS

Varieties

YELLOW PEAS

Century	all zones	large-seeded, yellow
Tara	all zones	medium-seeded, yellow
Trapper	all zones	small-seeded, yellow

GREEN PEAS

Triumph	all zones	large-seeded, green

Field peas are used mainly in the soup industry and are a good protein supplement for livestock, particularly swine. For good colour in both yellow and green peas, harvest soon after maturity. The green-seeded variety, Triumph, is more susceptible to weathering and bleaches easily if left in the fields. Seed should be inoculated with a recommended nodule forming bacterium prior to seeding.

Variety Description

Variety	Yield as % of Century	Days to Mature	Length of Vine cm (in)	Seed Weight g/1000	Protein %
Century	100*	90	111 (44)	232	25.2
Tara	118	92	105 (41)	207	24.7
Trapper	104	89	97 (38)	143	25.4
Triumph	105	93	78 (31)	293	25.5

*Average of 55 station years, 1974-82, Manitoba Cooperative Tests and Adaptation Trials — 2171 kg/ha (1939 lb/acre).

Seeding

Dates May 1 to May 25.

Rates Large-seeded - 170-200 kg/ha (2½ to 3 bu/acre).
Small-seeded - 130 kg/ha (2 bu/acre).

Depth 5 to 8 cm (2 to 3 inches).

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Nitrogen is not recommended. Phosphorus is recommended at 30 to 45 kg/ha (27 to 40 lb/acre) P_2O_5 as a sideband application. If applied with the seed the maximum rate of P_2O_5 recommended is 20 kg/ha (18 lb/acre). Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 35 to 70 kg/ha (31 to 62 lb/acre) potash (K_2O). Place potassium away from the seed. Twenty kg/ha (18 lb/acre) sulphur (S) is recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. For information on the application of different forms of sulphur fertilizer see page 18.

Weed Control

For recommended herbicides see Table 3.

Disease Control

Field peas are susceptible to a number of diseases which attack other broad-leaved crops. Use of seed tested for disease is strongly recommended to avoid losses from seed borne Ascochyta. Follow a crop rotation of at least four years between successive crops of peas to control Ascochyta and other soil borne diseases. Plant peas as far as possible from pea fields of the previous year. Bury refuse and stubble after harvest and control volunteer seedlings soon after emergence. Because of Sclerotinia disease, avoid field beans, field peas, lentils, mustard, canola, rapeseed, soybeans and sunflowers in the rotation. For further information see the section *Disease Control* and Table 1.

Desiccation

To chemically accelerate plant drying, desiccation may be used. It does not speed crop maturity, but will reduce the time from maturity to harvest. Refer to Manitoba Agriculture annual *Guide to Chemical Weed Control* for specific recommendations.

Insect Control

Aphids If white patches appear on pea foliage, severe damage can be expected. For recommended insecticides see Table 4.

FLAX

Varieties

Culbert	all zones
Dufferin	all zones
Linott	all zones
McGregor	all zones
NorLin	all zones

NorLin was released by Agriculture Canada, Research Station, Morden in 1982. It is slightly higher yielding than Dufferin and matures about 5 days earlier. NorLin is similar to Dufferin in oil quality but has a lower oil content. Seed of NorLin is being distributed by SeCan, but will not be available until fall, 1983.

Plant all varieties, but particularly Dufferin and McGregor, early for maximum yield. In northern areas and for late seeding, use the earlier maturing Culbert, Linott or NorLin. Sown early or late, Culbert yields slightly less than Linott, and may mature two to four days later.

Variety Description

Variety	Yield as % of Dufferin	Days to Maturity	Height cm (in)	Seed Weight g/1000	% Oil Content	Oil[2] Quality	Reaction to: Rust		Wilt
Culbert	92	100	57 (22)	6.0	42.5	192	Res.	Mod.	Res.
Dufferin	100[1]	103	65 (26)	5.7	43.3	185	Res.	Mod.	Res.
Linott	95	97	58 (23)	5.6	42.3	186	Res.	Mod.	Res.
McGregor	106	103	65 (26)	5.4	42.3	186	Res.	Mod.	Res.
NorLin	104	98	59 (24)	5.8	42.2	185	Res.	Mod.	Res.

[1]Average of 73 station-years, 1978-82, Manitoba Co-operative and Adaptation Trials — 1563 kg/ha (1394 lb/acre)

[2]Drying property measured in iodine units; values greater than 180 are considered acceptable.

Seeding

Dates Early maturing varieties - May 10 to June 10
Late maturing varieties - May 10 to May 30

These seeding dates represent a suggested maximum range. Location and climatic conditions will determine optimum seeding date.

Rates 30 to 45 kg/ha (27 to 40 lb/acre). Actual rate used will depend upon seedbed preparation, size of seed, percentage germination, moisture reserves and weed competition.

Depth 2.5 to 4 cm (1 to 1.5 inches). Flax should not be placed deeper than necessary to assure contact with moisture. Deeper seeding may result in decreased emergence and weaker plants. Shallow tillage before seeding will ensure a firm seedbed which promotes good stands and good plant vigor. If deep tillage is necessary, packing before or after seeding may be required.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

All fertilizer material should be placed away from the seed to avoid seed injury. When using anhydrous ammonia and aqua ammonia apply no less than five days before seeding.

	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)[1]		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
Flax to be grown on	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre
Fallow or legume breaking (2)	0	0	(3)	(3)	(4)	(4)	(5)	(5)
Grass and grass-legume breaking (2)	0-45	0-40	(3)	(3)	(4)	(4)	(5)	(5)
Stubble	45-70	40-62	(3)	(3)	(4)	(4)	(5)	(5)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) 30 to 45 kg/ha (27 to 40 lb/acre) of P_2O_5 is recommended if it can be applied 2.5 cm (1 inch) below the seed.

(4) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 35 to 70 kg/ha (31 to 62 lb/acre) of potash (K_2O).

(5) Low sulphur levels can occur in any Manitoba soil. For information on the application of different forms of sulphur fertilizer, see page 18.

Weed Control

For recommended herbicides see Table 3.

Disease Control

For seed rot and seedling blight control, flax seed should be treated (refer to Table 2). Follow a four year crop rotation and avoid legumes, potatoes and sugar beets because of Rhizoctonia disease (see Table 1).

Culbert, Dufferin, Linott, McGregor and NorLin are resistant to rust. Planting non-recommended rust susceptible cultivars, increases the risk of yield losses. To reduce the threat of pasmo and rust, use clean seed, control volunteer flax and plant early. Do not plant on or near flax stubble.

Insect Control

The Bertha army worm can cause damage to flax in the boll stage. For control recommendations, refer to the Manitoba Agriculture publication *Insect Control in Field Crops.*

Desiccation

Desiccation may be used to accelerate plant drying. It does not speed crop maturity but will reduce the time from maturity to harvest. Obtain a copy of the annual *Guide to Chemical Weed Control* for specific recommendations.

LENTILS

Varieties

Eston — All Zones
Laird

Chilean (common) lentils are not licensed in Canada but are commonly grown in Manitoba.

Variety Description

Type	Variety	Yield as % of (common)	Days to Mature	Seed Weight g/1000	Plant Height cm	(in)
Chilean (common)	—	100*	98	51	48	(19)
Persian	Eston	128	97	37	40	(16)
Chilean	Laird	91	100	70	54	(21)

*Average of 41 station years, 1978-82. — Manitoba co-operative and adaptation tests — 1616 kg/ha (1441 lbs/acre)

Seeding

Innoculate seed with a specific lentil inoculum.

Dates May 1 - 15

Rates 35 - 80 kg/ha (30 - 72 lb/acre) Large seeded varieties require the higher rates.

Depth 2.5 - 4 cm (1 - 1.5 inches)

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Nitrogen is not recommended. Phosphorus is recommended at 30 to 45 kg/ha (27 to 40 lb/acre) P_2O_5 as a sideband application. If applied with the seed, the maximum rate of P_2O_5 recommended is 20 kg/ha (18 lb/acre). Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 35 to 70 kg/ha (31 to 62 lb/acre) potash (K_2O). Place potassium away from the seed. Twenty kg/ha (18 lb/acre) sulphur (S) is recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. For information regarding the application of the different forms of sulphur fertilizer see page 18.

Weed Control

For recommended herbicides see Table 3.

Disease Control

Follow a crop rotation of four years for control of soil borne diseases. Avoid fababeans, field beans, field peas, mustard, canola, rapeseed, soybeans and sunflowers in the rotation because of Sclerotinia disease (white mold).

For further information, refer to the section Disease Control.

To prevent Ascochyta blight, plant only clean, non-discolored, sound seed. If there is doubt that the seed is free from the pathogen, obtain an agar plate test through the Plant Products and Quarantine Division, Agriculture Canada or the Plant Pathology Laboratory, Manitoba Agriculture. Turn under crop refuse soon after harvest, control volunteer seedlings and avoid planting lentils close to the previous year's field.

MUSTARD

Varieties

Yellow – Gisilba, Kirby, Ochre

Brown – Blaze

Oriental – Domo, Lethbridge 22A

Mustards are generally grown under contract with the contracting agency supplying the seed.

Variety Description

Kind of Mustard	Variety	Yield* kg/ha	(lb/acre)	Oil** (%)	Height** cm	(in)	Days to Maturity**
Yellow	Gisilba	1578	(1408)	26.5	94	(37)	88
Yellow	Kirby	1659	(1480)	26.9	97	(38)	89
Yellow	Ochre	1675	(1494)	26.9	94	(37)	89
Brown	Blaze	1636	(1459)	35.4	112	(44)	90
Brown (Common)	—	—***	—	36.2	106	(42)	89
Oriental	Domo	1885	(1682)	38.5	110	(43)	90
Oriental	Lethbridge 22A	1436	(1281)	37.9	111	(44)	90

* Average of 15 Tests in Manitoba (Co-operative Tests 1977-81; Regional Adaptation Trials 1981-82).

** Co-operative Tests in Manitoba (1977-81).

*** In Co-operative Tests in Manitoba (1977-81), the yield of Common Brown is 88% of that for Blaze.

Seeding

Dates May 5 to May 30.

Rate Yellow - 8 to 11 kg/ha (7 to 10 lb/acre)
Brown and Oriental 4.5 to 7 kg/ha (4 to 6 lb/acre)

Depth 2.5 to 5 cm (1 to 2 inches)

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Nitrogen in excess of 7 kg/ha (6 lb/acre) and phosphorus in excess of 20 kg/ha (18 lb/acre) and all potash and sulphur should be placed away from the seed to avoid seed injury. When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

Mustard to be grown on	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)[1]		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre
Fallow or legume breaking (2)	0-35	0-31	(3)	(3)	(4)	(4)	(5)	(5)
Grass and grass-legume breaking (2)	35-80	31-71	(3)	(3)	(4)	(4)	(5)	(5)
Stubble	80-100	71-89	(3)	(3)	(4)	(4)	(5)	(5)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) 30 to 45 kg/ha (27 to 40 lb/acre) of P_2O_5 as a sideband application about 2.5 cm (1 inch) to the side and 2.5 cm (1 inch) below the seed is recommended. No more than 20 kg/ha (18 lb/acre) should be placed with the seed.

(4) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 35 to 70 kg/ha (31 to 62 lb/acre) of potash (K_2O).

(5) Twenty kg/ha (18 lb/acre) of sulphur (S) are recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. For information on the application of different forms of sulphur fertilizer see page 18.

Weed Control

For recommended herbicides see Table 3.

Disease Control

Treat seed to control seed rot, seedling blights and black leg. See Table 2.

Follow a crop rotation of at least four years to control soil-borne diseases. Because of Sclerotinia disease (stem blight), faba-beans, field beans, field peas, lentils, canola, rapeseed, soybeans and sunflowers should be avoided in the rotation. For further information, see the section *Disease Control* and Table 1.

Insect Control

Flea beetles can be a problem on mustard. Seed treatments with Furadan or lindane are strongly recommended. For further control recommendations consult Table 4, and the Manitoba Agriculture publication, *Insect Control on Field Crops*

Desiccation

Desiccation may be used to chemically accelerate plant drying. It does not speed crop maturity but will reduce the time from maturity to harvest. Refer to the *Guide to Chemical Weed Control* for specific recommendations.

Harvesting

Yellow mustard is resistant to shattering but the pods tend to break off under windy conditions. Harvest when pods are fully mature.

Brown and Oriental mustard are less resistant to shattering and are usually swathed. Since green seeds are a degrading factor, leave the crop standing as long as possible.

Swathing should commence when the ripest pods show signs of shattering. At this stage 75 per cent of the seeds may have reached their mature colour (yellow or brown). In order to minimize shattering, swath under dewy conditions.

POTATOES

Varieties

Early Crop	Storage Crop
Red - Norland	Red - Norland, Red Pontiac
White- Warba	White - Norchip, Kennebec, Shepody
	Russet - Russet Burbank

Variety Description

Warba An early maturing variety with a white skinned, pink deep eyed, scab susceptible tuber suitable for early initial harvest and table stock use. Commercial market acceptability is for a very limited volume over a short period of time.

Norland A good yielding early maturing variety with red skinned, shallow eyed tubers suited for early harvest and storage until mid-winter.

Norchip A good yielding, medium maturing variety with white skinned high specific gravity tubers. It has acceptable chipping characteristics and a short dormancy period.

Kennebec A very late maturing high yielding variety with white skinned, shallow eyed tubers suitable for chipping. It is susceptible to greening.

Red Pontiac A high yielding drought tolerant variety with red skinned, medium deep eyed tubers of low dry matter content. Suitable for table stock use.

Russet Burbank A high quality, late maturing variety with russet skinned, long, shallow eyed tubers suitable for processing (other than chips), baking and table stock use. Its tuber shape can be extremely variable if plants are subject to stress during the tuber enlargement period of growth.

Shepody A high quality, late mid-season maturing variety with large, white skinned, oblong to elliptical tubers. Yield, specific gravity and french fry color are similar to Russet Burbank. First harvest for processing is expected to be acceptable at a minimum of 10 to 14 days earlier than Russet Burbank.

Seed Quality and Handling

Use Foundation or Certified seed. Tubers up to 80 g (3 ounces) should be planted whole. Cut larger tubers into blocky seed pieces 40 to 55 g (1.5 to 2 ounces) in size. Chips and slivers weighing less than 28 g (1 ounce) should be discarded. To reduce the risk of seed piece decay and reduced stands use these fungicidal treatments: thiophanate-methyl (Easout), metiram (Polyram), captan or mancozeb.
For rapid emergence, particularly with late maturing varieties plant seed in warm moist soil.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

All fertilizer should be added as a sideband application at time of seeding for the most efficient use of the fertilizer. No more than 90 kg/ha (80 lb/acre) nitrogen in urea form should be applied as a sideband application at time of seeding. When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)(1)		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
Potatoes to be grown on	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre
Fallow or legume breaking (2)	35-50	31-45	50-60	45-54	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	50-70	45-62	50-60	45-54	(3)	(3)	(4)	(4)
Stubble	70-100	62-89	50-60	45-54	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 50 to 90 kg/ha (45 to 80 lb/acre) of potash (K_2O).

(4) Twenty kg/ha (18 lb/acre) of sulphur (S) are recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. For information regarding the application of the different forms of sulphur fertilizer refer to page 18.

Disease Control

Follow a crop rotation of four years to control soil-borne diseases. Avoid alfalfa, flax, canola, rapeseed, sugar beets, sunflowers and sweet clover in the rotation (see Table 1). Control volunteer plants which may be sources of virus disease and late blight.

Bacterial Ring Rot and Blackleg Equipment and storage areas should be sanitized regularly to reduce the spread of bacterial ring rot and blackleg. Use steam or a high pressure washer to clean the surface of equipment and follow with a suitable disinfectant such as Formaldehyde (dil. 1:8), Phenol (Ken-Germ), quarternary ammonium (Hy-X, Potato Gard, or Teramine), sodium hypochlorite (household bleach, dil 1:2). Carefully dispose of cull tubers to eliminate possible sources of inoculum of bacterial diseases.

Blight Early blight and late blight can be controlled by fungicidal sprays. A regular spray program using maneb, mancozeb, metiram (Polyram), captafol (Difolatan), chlorothalonil (Bravo), anilazine (Dyrene), zineb or fixed copper, should be practised according to directions on the label.

Storage Diseases For control of silverscurf and fusarium, treat dry rot tubers with the fungicide thiabendazole (Mertect) as they are being put into storage. Export potatoes should not be treated at the Canadian rate.

Additional information is available in the Manitoba Agriculture annual publication *Vegetable Crop Production Guide.*

Insect Control

Leafhoppers, flea beetles, aphids, and Colorado potato beetle are the major insect pests of potatoes. See Table 4 for recommended insecticides and the Manitoba Agriculture publications *Insect Control on Vegetables* and *Vegetable Crop Production Guide.*

Weed Control

Timely tillage with harrows, mulchers, and cultivators supplemented with chemical weed control can be used to effectively control most weeds in potatoes. Timing of operations and chemical control measures must be selected for specific field conditions and weed problems. Specific recommendations are contained in the *Guide to Chemical Weed Control.*

Sprout Inhibition

Potatoes can be chemically sprout inhibited by field treatment using maleic hydrazide (M.H.- 30). Contract application of C.I.P.C. (Sprout Nip) is necessary to control sprout growth on potatoes in storage because of warm storage requirements, short dormancy period, or long term storage.

Vine Killing

Use of one of several desiccants will kill top growth and assist in stopping growth of tubers and induce maturity for harvest. Recommendations are included in the *Guide to Chemical Weed Control.*

Storage

Potatoes require specialized storage to prevent frost injury and temperature fluctuation, and provide for air circulation and a high relative humidity. Acceptable table stock quality can be retained until late spring by maintaining a temperature of 4°C with a relative humidity of 90 per cent. Potatoes produced for processing require different storage temperatures. For specific recommendations, consult your processing company representative.

Mechanical Damage

The greatest single loss of tubers of marketable size and type stems from mechanical damage. Growers must exercise great care throughout the production, harvest, storage, and delivery periods to handle tubers carefully and reduce the loss resulting from mechanical injury. Careful management and attention will pay a good dividend.

NOTE: Additional information on potato practises and recommendations is available in the publication *Vegetable Crop Production Guide.* Growers producing potatoes for processing firms under contract should note and follow the company's requirements in using chemicals for crop production.

SOYBEANS

Varieties

Maple Amber — 000 maturity group cultivar adapted to areas with a minimum corn heat unit accumulation of approximately 2300 or more corn heat units.

Maple Presto — 000 maturity group cultivar adapted to areas with a minimum corn heat unit accumulation of approximately 2200 or more corn heat units.

McCall — 00 maturity group cultivar adapted to areas with a minimum corn heat unit accumulation of approximately 2500 corn heat units.

Soybeans are placed into maturity groups based on their photoperiod sensitivity. 00 maturity group soybeans are the earliest maturing photoperiod sensitive soybeans, adapted for production in the 45 to 50° latitude range. 000 maturity group soybeans are very early maturing photoperiod insensitive soybeans adapted for production at high latitudes.

Seed treatment with the specific inoculum is essential.

Variety Description

Variety	Yield as % of Maple Presto	Seed Weight g/1000	Days to Maturity Average	Days to Maturity Range	Protein Content %	Oil Content %	Height cm	Height (in)
Maple Amber	119	174	115	106-130	41.1	20.2	73	(29)
Maple Presto	100[1]	167	106	94-112	39.7	19.9	64	(25)
McCall	130	155	124	109-134	39.8	18.9	77	(30)

[1]Average of 42 station years, 1979-1982, 1971 kg/ha (1758 lb/acre)

Seeding

Date: May 15 to May 25
Rate: 130 kg/ha (116 lb/acre)
Depth: Clay — Clayloam 2 to 3 cm (.75 to 1.2 in)
Loam — Sandyloam 2 to 4 cm (.75 to 1.5 in)

Soybeans are sensitive to certain herbicides residues such as atrazine. Take extreme care in applying herbicides to any crop that is to precede a soybean crop. A row spacing of 50 cm (20 inches) is recommended. Narrow rows are advisable when using a grain drill. Seeding with a grain drill appears to be the most practical method. Care must be taken in calibration.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Nitrogen is not recommended. Phosphorus is recommended at 30 to 45 kg/ha (27 to 40 lb/acre) P_2O_5 as a sideband application or as an application 2.5 cm (1 inch) directly below the seed. If applied with the seed the maximum rate of P_2O_5 recommended is 20 kg/ha (18 lb/acre). Sands, sandy loam, and organic soils are frequently low in available potassium. On these soils apply 35 to 70 kg/ha (31 to 62 lb/acre) potash (K_2O). Potassium should be placed away from the seed.

Twenty kg/ha (18 lb/acre) sulphur (S) is recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. For information on the application of different forms of sulphur fertilizer, see page 18.

Weed Control

For recommended herbicides see Table 3.

Disease and Insect Control

Follow a crop rotation of four years to control soil-borne diseases (see Table 1). Avoid fababeans, field beans, field peas, lentils, mustard, canola, rapeseed and sunflowers in the rotation because of Sclerotinia disease. For control of seedling rot, seedling blights, and seed maggots, apply a seed treatment as recommended in Table 2. For further information see the section *Disease Control.*

Harvesting

Harvest soybeans when pods are dry and the soybeans are hard. Swathing and combining or direct combining may be used. A floating cutterbar attachment on the swather or combine is useful. To prevent shattering, swath the soybeans in the morning when pods are moist and tough. Careful adjustment of the cylinder speed and concave clearance is critical to minimize cracking and splitting of soybeans.

SUGAR BEETS

This crop is grown under contract with Manitoba Sugar Company and seed is provided under the contract.
Sugar beets require relatively light to medium textured soils that are well drained. This allows earlier planting and easier establishment of good stands in spring and easier harvesting in fall.

Seeding

Dates As early as possible, about May 1.

Rates Space seeds 7 5 cm (3 inches) apart if beet thining is planned (2.7 kg/ha)(2.4 lb/acre)
Space seeds 15 cm (6 inches) apart if planting to a final stand without thinning (1.3 kg/ha)(1.2 lb/acre)

Depth 2.5 to 3.5 cm (1 to 1.4 inches) depending on seedbed conditions.

Row Spacing 56 cm (22 inches) between rows.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Drill no more than 20 kg/ha (18 lb/acre) phosphate with the seed. Work the remaining phosphate in before planting. Any nitrogen above 5 kg/ha (4 lb/acre) and all potash and sulphur should be applied prior to planting. When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

RATE OF NUTRIENT TO ADD

Beets to be grown on	Nitrogen (N)[1] kg/ha	Nitrogen (N)[1] lb/acre	Phosphate (P_2O_5) kg/ha	Phosphate (P_2O_5) lb/acre	Potash (K_2O) kg/ha	Potash (K_2O) lb/acre	Sulphur (S) kg/ha	Sulphur (S) lb/acre
Fallow or legume breaking (2)	0-20	0-18	65	58	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	20-65	18-58	65	58	(3)	(3)	(4)	(4)
Stubble	65-100	58-89	65	58	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 50 to 90 kg/ha (45 to 80 lb/acre) of potash (K_2O).

(4) Twenty kg/ha (18 lb/acre) of sulphur (S) are recommended on well-drained sandy soils. For information on the application of different forms of sulphur fertilizer see page 18.

Disease Control

Follow a crop rotation of at least three years to control soilborne diseases (see Table 1). Avoid canola, rapeseed and mustard in the crop rotation because of sugar beet cyst nematodes. All seed is treated against damping-off diseases prior to sale.

Insect Control

Guthion satisfactorily controls early damage to stands from outbreaks of flea beetles.

The sugar beet root maggot is regularly found in Manitoba and produces significant losses in light soil areas. See Table 4 for recommended insecticides. Cutworms may cause severe stand losses in early spring, but can be controlled with Lorsban. Occasional outbreaks of webworm are treated with Dylox.

Weed Control

For recommended herbicides see Table 6.

NOTE: *Avoid seeding sugar beets on fields previously treated with Glean.*

TABLE 6 — HERBICIDES FOR SUGAR BEETS

HERBICIDES \ WEEDS	Barnyard Grass	Cereal Grains	Foxtail, Green	Foxtail, Yellow	Wild Oats	Quack Grass	Buckwheat, Wild	Chickweed	Henbit	Kochia	Lamb's-Quarters	Mustard, Wild	Nightshade	Pigweed, Prostrate	Pigweed, Red Root	Pigweed, Tumble	Purslane	Shepherd's Purse	Annual Smartweed Species, Lady's Thumb	Stinkweed
Avadex BW					●															
Basfapon/Dalapon/Dowpon/Dowpon M			●	●																
Betanal			●	●			●			●	●	●								
Betanex							●				●	●			●					●
Carbyne 2 EC/Wypout/Wypout 250					●															
Eptam	●	●	●	●	●	S		●	●		●		●	●	●	●	●			
Gramoxone[a]	CONTROLS ANNUAL WEED SEEDLINGS AND TOP GROWTH OF PERENNIAL WEEDS																			
Herbicide 273							●												●	
Hoe-Grass	●		●	●	●															
NaTA TCA/TCA Solution			●	●																
Nortron	●	●	●	●	●					●	●				●		●	●	●	
Ro-Neet	●		●	●	●				●		●		●		●		●			
Roundup[a]	CONTROLS ANNUAL WEED SEEDLINGS AND TOP GROWTH OF PERENNIAL WEEDS																			

LEGEND a = apply to emerged weeds before or after planting but before sugar beets emerge
● = controlled by rates recommended for use in sugar beets
S = suppression only

SUNFLOWERS

Varieties

All oilseed varieties listed in the variety description table are recommended in Zones 1 and 2 (south of township 18), and Zones 2A, 3, 3A, and 4 (south of township 19).

The confectionery variety Sundak is recommended only in Zones 3 and 3A.

Variety Description

Variety	Type**	Yield as % of 894	Days to Maturity	Oil %	Resistance to Rust	Resistance to Verticillium Wilt	Resistance to Downy Mildew
Oil Type							
Cargill 204	H	104	117	44.3	Fair-Poor	Good	Good
Cargill 205	H	102	116	46.5	Fair-Poor	Good	Good
*Cargill 206	H	105	119	45.6	Fair-Poor	Good	Fair
D0164	H	105	114	43.6	Good	Good	Good
D0844	H	102	116	43.7	Good	Good	Good
*7101 (IS)	H	106	115	45.0	Fair-Poor	Good	Good
*IS 7775	H	102	119	44.2	Fair-Poor	Good	Good
*J-401	H	103	114	43.2	Good	Good	Fair
J-501	H	100	115	44.7	Fair-Poor	Good	Fair
PAG SF 101	H	101	115	46.4	Fair-Poor	Good	Good
*PAG SF 102	H	102	119	45.7	Fair-Poor	Good	Fair
SigCo 450	H	99	116	45.6	Fair-Poor	Good	Fair
*SigCo 894A	H	100	118	44.6	Fair-Poor	Good	Good
Sunbred 265	H	102	117	46.0	Good	Good	Good
*TNT 134 A	H	101	117	44.6	Fair-Poor	Good	Good
894	H	100***	118	44.0	Fair-Poor	Good	Good
Saturn	OP	83	111	44.5	Poor	Fair-Poor	Poor
Confectionary Type							
Sundak	OP	92	119		Good	Fair-Poor	Poor

* On recommended list for the first time

** H = hybrids, OP = open-pollinated

*** Average 23 station-years, 1979-82 — All Manitoba — 2282 kg/ha (2038 lb/acre)

Seeding

Dates All varieties should be seeded early if possible. Seedlings are relatively frost resistant up to the four leaf stage. If late seeding is necessary, Saturn or early maturing hybrids should be used.
Zone 3, south of Township 15: May 1 to June 5.
All other regions: May 1 to May 15.

Rates A final population of 40,000 to 49,000 plants/ha (16,000 to 20,000 plants/acre) is recommended for oil type cultivars and hybrids. For Sundak, a population of not more than 45,000 plants/ha (18,000 plants/acre) is recom-

mended to ensure large seeds. Consider seed size in determining the quantity of seed required for seeding. Allowance must be made for low germination, reduced emergence, and the number of harrowings anticipated. Plant population depends on distance between rows and on spacing between plants within the row. See following table.

	Row spacing — cm (inches)				
Plants/ha (acre)	**40(16)**	**46(18)**	**56(22)**	**76(30)**	**91(36)**
	Average seed spacing within row — cm (inches)				
40,000 (16,000)	58(23)	50(20)	41(16)	30(12)	25(10)
45,000 (18,000)	51(20)	44(17)	36(14)	26(10)	22(9)
49,000 (20,000)	46(18)	40(16)	33(13)	24(9)	20(8)

Stands may be reduced by harrowing. The frequency and severity of harrowing will determine the percent stand reduction, and seeding rate is increased accordingly.

Sunflower seed is sold in different sizes. The approximate number of seeds for the different sizes are:

	Seeds/kg	(Seeds/lb)
Seed size No. 2	11,000 - 13,200	(5,000 - 6,000)
Seed size No. 3	13,200 - 15,400	(6,000 - 7,000)
Seed size No. 4	15,400 - 19,800	(7,000 - 9,000)
Seed size No. 5	19,800 - 24,200	(9,000 - 11,000)

Depth: Seed should be placed into moisture even if this means seeding to 8 to 10 cm (3 to 4 inches)

Fertilizer

For specific target yield recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

Germinating sunflower seeds are sensitive to moderate amounts of fertilizer placed with the seed.

Row Equipment When sunflowers are seeded with row equipment, all phosphorus and potash should be side-banded at seeding time. Some or all of the nitrogen may also be side-banded. The total amount of fertilizer material side-banded should not exceed 340 kg/ha (303 lb/acre).

Discer Seeder When sunflowers are solid-seeded with a discer seeder in 30 to 60 cm (12 to 24 inches) row spacing, up to 25 kg/ha (22 lb/acre) P_2O_5 can be applied provided all fertilizer runs are left operating. If all phosphorus must be placed with the seed, the amount of phosphorus should not exceed 15 kg/ha (13 lbs/acre) for 30 cm (12 inches) row spacing, 10 kg/ha (9 lb/acre) for 45 cm (18 inches) row spacing and 5 kg/ha (4 lb/acre) for 60 cm (24 inches) row spacings.

Nitrogen requirements not side-banded should be placed away from the seed as a band or broadcast application. When the crop is seeded less than five days after the application of anhydrous ammonia and aqua ammonia, damage may occur particularly on sandy soils or under dry soil conditions.

Sunflowers to be grown on	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)[1]		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre	kg/ha	lb/acre
Fallow or legume breaking (2)	0-30	0-27	30-45	27-40	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	30-60	27-54	30-45	27-40	(3)	(3)	(4)	(4)
Stubble	60-100	54-89	30-45	27-40	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 15 to 35 kg/ha (13 to 31 lb/acre) of potash (K_2O).

(4) Twenty kg/ha (18 lb/acre) of sulphur (S) are recommended on well-drained sandy soils. For information on the application of different forms of sulphur fertilizer see page 18.

Weed Control

Cultural Methods Cross harrowing (after planting, before and after emergence of the sunflowers) with early inter-row cultivation will usually give satisfactory control of most weeds.

For recommended herbicides see Table 3.

Disease Control

Sclerotinia wilt or basal stem rot, Verticillium wilt, rust and downy mildew are serious sunflower diseases.

No cultivar is resistant to Sclerotinia disease. Sclerotinia wilt spreads by root contact, and the denser the plants, the greater its incidence and severity. Do not exceed the recommended seeding rates, and space plants uniformly. Plant to plant spread of the disease is reduced at spacings of 30 cm (12 inches) and larger, and is prevented at 40 cm (16 inches). Use well cleaned seed free of sclerotia (black, hard fungal bodies).

Follow a crop rotation of at least five years to control soilborne diseases in general. Avoid fababeans, field beans, field peas, lentils, mustard, canola, rapeseed and soybeans in the rotation to control Sclerotinia disease. The organisms that cause Verticillium wilt and downy mildew survive in soil for many years, and are best controlled by planting resistant varieties. For further control of Verticillium wilt, avoid alfalfa, potato and sweet clover in the rotation. To reduce the incidence of rust use resistant varieties, control volunteer plants and do not sow sunflowers adjacent to sunflower stubble. To reduce the incidence of downy mildew, avoid planting in poorly drained fields. For further information see the section *Disease Control* (p. 6) and also Table 1.

Insect Control

The sunflower beetle in both adult and larvae stages can cause serious damage. For control measures, refer to the Manitoba Agriculture publication *Insect Control on Field Crops).*

Harvesting

The period between maturity and harvest should be kept as short as possible to keep to a minimum losses due to bird damage and/or head rot diseases. Rather than waiting for a frost, a desiccant may be used to accelerate drying of sunflower plants. For details, see the *Guide to Chemical Weed Control.*

WILD RICE

Wild rice may be produced in paddies containing 15 to 45 cm (6 to 18 inches) or more of water. Seeding at a rate of 35 kg/ha (30 lb/acre) can be done by broadcasting into water or onto wet ground which is then flooded either in the fall or spring. Fall seeding is an advantage since the problems of seed storage are avoided. Paddies may be harvested with float mounted equipment or drained and harvested with a combine equipped with extended tracks and a rice header.

Shallow peat or mineral soils in the natural wild rice area are used for wild rice production. Soil conditions that permit maintenance of adequate water levels in the paddies are essential.

The quantity of water available should be carefully assessed. A licence must be obtained before paddy construction.

Initial dike construction should facilitate patrol, maintenance and sanitation. Control of plant growth on dikes assists in weed and disease control in the paddies.

Weed Control

Major problem weeds include cattails, burr weed and duck weed. Some control can be achieved through water level management and fall tillage.

Disease, Insect and Variety Notes.

Stem rot disease may cause loss. Wild rice worm consumes the grain from pollination onwards. Native wild rice shatters readily and ripens unevenly although some recently developed varieties provide a degree of shatter resistance with acceptable maturity characteristics. For further information see the Manitoba Agriculture factsheet *Wild Rice Production.*

TABLE 7 — PERFORMANCE OF CORN HYBRIDS

Morden, Winnipeg, Brandon 1981-82

Hybrids recommended for grain and silage

Heat unit rating **	Brand and/or Hybrid name	Hybrid type	Days to silk	Stalk break. (1-5) ***	Root lodg. (1-5) ***	Grain density (% of mean)	Grain moist. (%)	Grain yield (% of mean)	Forage yield (% of mean)	Plant moisture (%)
2150 —	Limagrain Euros LG-3	3W	74	2.6	1.1	104	23.0	91	77	60.4
	Pioneer 3995	3W	74	2.5	1.7	102	22.8	89	90	61.3
	Funk C4005	3W	76	2.2	2.0	103	23.0	104	106	61.1
	N.K. PX403	3W	76	2.6	2.0	101	23.1	93	98	57.9
	Pickseed 2020*	SC	77	2.6	1.5	103	21.9	102	94	59.7
2200 —	Pioneer 3886	DC	74	2.5	1.7	101	24.8	91	93	64.4
	Pioneer 3993	3W	74	2.0	1.5	101	24.2	96	93	63.1
	Pioneer 3994	3W	74	2.5	2.0	99	23.8	89	90	62.3
	Pioneer 3996	3W	77	2.1	1.0	102	21.8	104	96	58.5
	Dekalb TX17	3W	77	2.9	2.2	101	22.6	96	94	59.4
	Funk G4083	SC	77	2.0	1.0	103	24.8	105	109	64.3
	Hyland HL1125*	3W	77	3.4	1.0	101	24.3	102	—	—
2250 —	Limagrain LG152	3W	75	2.7	1.5	102	25.3	102	98	60.3
	N.K. PX9040*	3W	77	2.8	1.5	98	22.7	100	92	58.7
	P.A.G. SX104	OC	76	1.9	1.0	100	24.1	98	101	61.8
	Pickseed 2011	3W	76	2.7	2.6	101	25.4	95	90	58.9
	Pickseed 2111	3W	76	2.7	2.1	102	24.3	102	99	59.3
	Pride R090	OC	78	3.0	1.0	97	23.0	105	104	58.9
	Dekalb DK23	3W	79	2.8	2.1	98	23.8	93	98	62.7
	P.A.G. 501	3W	78	2.9	1.5	101	24.4	102	112	63.3
2300 —	Pickseed 2555A*	MSC	78	2.6	1.5	99	24.8	107	105	60.7
	Pride 111*	SC	79	2.7	1.0	96	23.8	111	112	60.4
	Asgrow RX17	3W	78	2.7	1.6	96	27.9	100	112	62.1
	Asgrow RX22	3W	80	2.7	2.7	99	24.9	102	105	62.9
	Dekalb DK24	3W	80	2.7	2.0	97	25.6	104	112	64.5
2350 —	Dekalb T722*	3W	79	2.8	2.2	99	25.8	104	—	—
	Pickseed XR14	SC	77	2.8	2.2	98	27.1	98	104	64.3
	Pride R112	3W	78	2.0	1.6	96	25.9	100	100	63.0
	Stewart 244	3W	78	2.6	2.1	99	25.2	107	118	64.3

* On the recommended list for the first time

** Entries arranged alphabetically **within** heat unit categories. H.U. requirement of a hybrid may vary slightly from year to year, therefore relative yearly rankings may change

*** Rating 1 to 5 (1 is best)

Mean Grain Density = 695.9 kg/m³

Mean Grain Yield = 5.7 t/ha (90.8 bu/ac)

Mean Silage Yield = 12.6 t/ha

Mean Moisture = 24.4%

TABLE 7 — PERFORMANCE OF CORN HYBRIDS

Morden, Brandon, Winnipeg 1981-82

Hybrids recommended for silage only.

Heat unit rating	Brand and/or hybrid name	Hybrid type	Days to silk	Plant yield (% of mean)	Plant moisture (%)
2400 –	Asgrow RX23	3W	75	93	63 0
	Dekalb TK778*	OC	80	101	63 5
	U Co-op S259	SC	79	102	61 1
	W Master CD3	3W	78	90	61 2
2450 –	Funk G4055	3W	79	101	65 7
	Funk G4065	OC	80	101	65 7
	Funk G4086	3W	78	97	64 5
	P A G SX111	SC	80	101	65 5
	Pioneer 3957	SC	78	100	64 1
	Pride R108	3W	79	93	65 5
	Pride 1131	SC	81	106	65 5
	Stewart 2660	SC	80	100	65 5
	U Co-op 2610	OC	80	101	65 7
2500 –	Asgrow RX29	DC	82	103	67 1
	Cargill 810	SC	80	108	66 9
	N King PX11	SC	81	99	66 9
	N King PX414	3W	79	93	66 3
	Pickseed 2322	3W	79	101	66 3
	Pride 1128	SC	81	101	66 7
2550 –	Asgrow RX295	3W	82	102	67 4
	Dekalb XL6	SC	82	95	67 6
	Hyland HL2428*	SC	82	118	67 5
	N King PX419	3W	81	97	67 5
	Pau Cuzco 251	3W	77	94	67 3

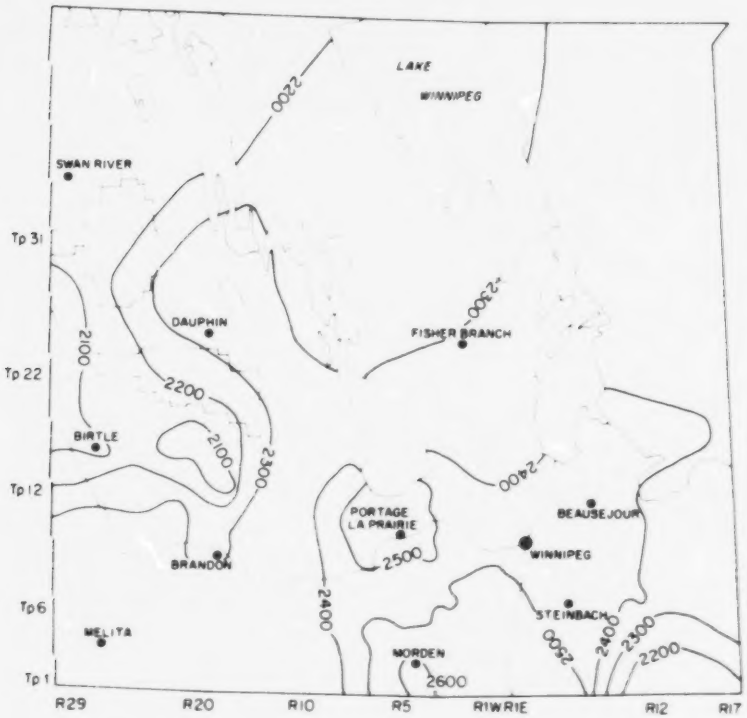
* On the recommended list for the first time

Mean silage yield = 15.2 t/ha (6.7 t/ac)

Entries listed alphabetically **within** Heat Unit categories

Heat Unit ratings based on HU requirement to mature grain corn

Figure 2 — Corn Heat Unit Map for Manitoba



Corn Heat Units

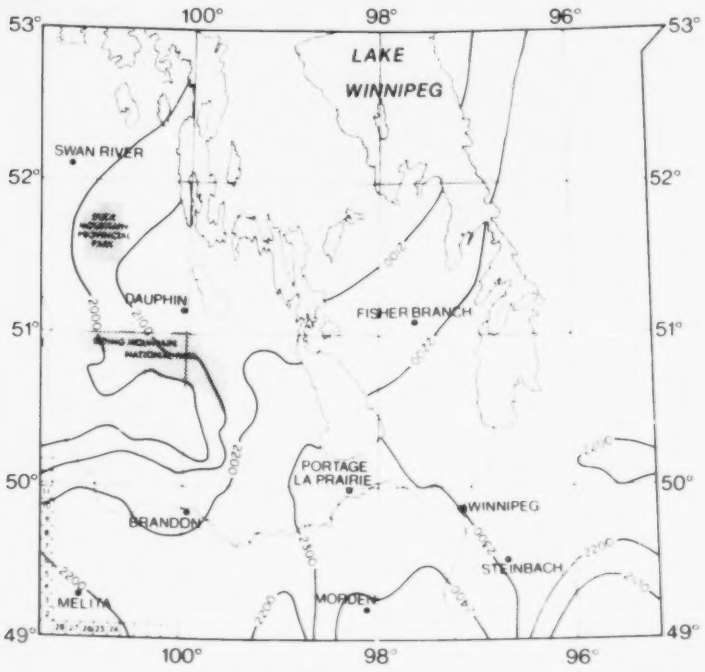
The corn production potential of an area is determined primarily by the corn heat unit accumulation. These units are calculated each day from May 15 to the date of the first frost at −2°C in the fall. Daily accumulations are summed to give a seasonal total. The map above is an average seasonal accumulation.

HOW TO USE THE MAP

If you plan to grow corn for grain, find your farm location on the map and observe the heat units available. When planting in early May, choose hybrids with a heat unit rating no greater than that available on your farm. If, for any reason, planting is delayed until after mid-May, deduct 100 heat units from the rating for your farm for each week of delay and select hybrids accordingly.

For silage corn the heat unit requirement is 200 lower than for grain corn since silage is harvested before full maturity. Hybrids requiring 200 heat units more than the rating for a farm can be used in silage production, e.g. a 2,400 heat unit hybrid may be used in a 2,200 heat unit area.

Figure 3 — Minimum Accumulation of Corn Heat Units at a 25% Risk

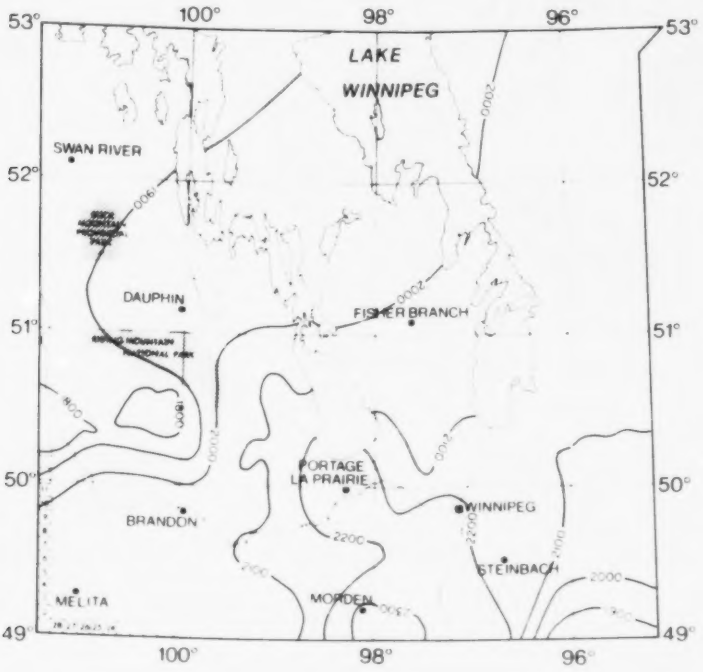


REDUCING THE RISK IN CORN PRODUCTION

The corn heat unit map shown in **Figure 2** is the average corn heat unit accumulation, i.e. in approximately one-half the years the actual corn heat unit accumulation will be more than that shown on the map, while in the other half of the years, it will be less. Thus the map is a 50% risk map. If you chose a hybrid with the same heat unit rating as your farm, 50% of the years it would not reach maturity.

Let us assume you want to reduce your risk to 25%, i.e. you are prepared to have immature corn one year in four. In this case instead of using the average corn heat unit map **(Figure 2),** you would use the 25% risk map **(Figure 3)** in choosing your hybrid. Similarly, if you wish to reduce your risk to 10%, you would use the 10% risk map **(Figure 4)** in choosing your hybrid.

Figure 4 — Minimum Accumulation of Corn Heat Units at a 10% Risk



Management Practices

Successful corn production requires intensive management. New growers should consult their nearest agronomist for detailed advice on the proper techniques and materials for planting, fertilizing, spraying, harvesting, storage, etc. Obtain a copy of the Manitoba Agriculture publication *Field Corn in Manitoba.* Corn crops properly managed in all aspects of production, hold good potential for high yields. However, improper management of any one aspect of production may lead to poor results - unlike cereals in which average management usually leads to average yield. Basic recommended practices are:

Soil Requirements Corn is best adapted to well-drained, light to medium sandy loam soils. These soils usually permit early May planting, which is essential for optimum yields of good quality grain. Corn should not be grown on soils that are either poorly drained or saline (showing a conductivity reading above one millisiemen by soil test).

Seeding

Dates May 1 to May 15. Later planting results in lower yields and quality. Planting later than May 25 for grain and June 5 for silage is not recommended.

Depth Plant into moist soil. Under normal soil moisture conditions the suggested depth is 2.5 to 5 cm (1 to 2 inches). Very dry soil conditions may require deeper planting. Check planting depth frequently to ensure uniform and early emergence.

Row Spacing Seventy five to 100 cm (30 to 40 inches) depending on planting and harvesting equipment.

Rates Hybrid corn is sold in many sizes. Growers using plate-type planters must use the correct plate for each seed size to obtain the desired plant population.

Grain corn - 45,000 to 60,000 plants/ha (18,000 to 24,000 plants/acre)

Silage corn - 55,000 to 70,000 plants/ha (22,000 to 28,000 plants/acre)

The lower plant populations are recommended for areas in which moisture is a limiting factor. Similarly, plant population should be reduced if planting is delayed beyond the recommended dates. Plant population depends on seed spacing within the row and on spacing between rows. See following table:

Seed Spacing Necessary to Give the Required Plant Population Assuming an 85% Plant Survival

Row Width cm (inches)	Plants per ha(acre) 45,000 (18,000)	Plants per ha(acre) 49,000 (20,000)	Plants per ha(acre) 55,000 (22,000)	Plants per ha(acre) 60,000 (24,000)	Plants per ha(acre) 69,000 (28,000)
	cm(in)	cm(in)	cm(in)	cm(in)	cm(in)
76(30)	25(9.9)	23(8.9)	20(8.1)	19(7.4)	16(6.3)
91(36)	21(8.2)	19(7.4)	17(6.7)	16(6.2)	14(5.3)
97(38)	20(7.8)	18(7.0)	16(6.4)	15(5.8)	13(5.0)
102(40)	19(7.4)	17(6.7)	15(6.1)	14(5.6)	12(4.8)

Fertilizer

For specific target yield recommendations have your soil tested. Samples should be taken at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

All nitrogen, phosphate and potash should be banded at time of seeding, if possible. The total amount of fertilizer material side-banded should not exceed 340 kg/ha (303 lb/acre). Nitrogen requirements not side-banded at time of seeding should be side-dressed before the corn is 15 cm (6 inches) high.

Corn to be grown on	RATE OF NUTRIENT TO ADD							
	Nitrogen (N)[1]		Phosphate (P_2O_5)		Potash (K_2O)		Sulphur (S)	
	kg/ha	lbs/acre	kg/ha	lbs/acre	kg/ha	lbs/acre	kg/ha	lbs/acre
Fallow or legume breaking (2)	0-30	0-27	30-45	27-40	(3)	(3)	(4)	(4)
Grass and grass-legume breaking (2)	30-75	27-67	30-45	27-40	(3)	(3)	(4)	(4)
Stubble	75-150	67-134	30-45	27-40	(3)	(3)	(4)	(4)

(1) Rates are based on granular nitrogen applied broadcast at or near seeding time. See section Relative Efficiencies of Time and Method of Application, page 15.

(2) Refers to breaking after first cut of forage.

(3) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 30 to 110 kg/ha, (27 to 98 lb/acre) of potash (K_2O).

(4) Twenty kg/ha (18 lb/acre) of sulphur (S) are recommended on well-drained sandy soils. For information on the application of different forms of sulphur fertilizer see page 18.

Excess nutrient levels may occur when high rates of fertilizer are used on continuous corn. Soil testing to a depth of 60 cm (24 inches) is strongly recommended to monitor nutrient levels and avoid over-fertilization.

To determine the possible cause of poor growth due to nutrient deficiencies, see pages 20 and 21 of the publication, *Field Corn in Manitoba*, and contact your local agronomist.

Disease Control

Stalk rot is considered the main disease of corn. It causes diseased plants to break over before harvest, resulting in severe losses. Organisms causing the disease are present in all soils. The disease usually occurs following periods of severe stress such as drought, or prolonged cool weather. For control measures, see the Manitoba Agriculture publication *Field Corn in Manitoba*. Continuous cropping of corn can lead to a buildup of stalk rot and corn smut. Rotate with cereals or special crops for several years before returning field to corn (see Table 1). The *Crop Rotation Chart* published by Manitoba Agriculture contains further information on crop rotations.

Insect Control

Wireworm and root maggot damage has been noted in some areas of Manitoba. A seed treatment such as DCL (Diazinon, captan, lindane) is recommended for control. For control of cutworms and other insects that may attack corn, see Table 4. European corn borers have appeared in localized outbreaks in some seasons. Damage to crops is caused by the larvae boring in the stalks and ears. Stalk breakage may occur if the infes-

tation is heavy. Control measures are not recommended as infestations are rarely numerous enough to cause significant lodging.

Pest Control

Blackbirds can cause severe losses in corn production. Placement of corn field close to sloughs and marshes should be avoided, where possible.

Harvesting

The grade of grain corn may be significantly influenced by harvesting procedure. Grain corn should contain 25 to 30 per cent kernel moisture before harvesting commences. Harvesting near the lower end of this moisture range causes a lower proportion of cracks and fines. If frost occurs before kernel moisture has reached 40 per cent harvest the crop for silage rather than grain. Silage corn harvesting should take place when whole plant moisture is 65 to 70 per cent. Then, the kernels are usually at the hard dough stage (well-dented or glazed).

Weed Control

For recommended herbicides see Table 8.

TABLE 8 — HERBICIDES FOR CORN

| HERBICIDES \ WEEDS | Barnyard Grass | Cereal Grains | Foxtail Green | Foxtail Yellow | Wild Oats | Quack Grass | Bindweed Field | Blue Burr | Buckwheat Volunteer | Buckwheat Tartary | Buckwheat Wild | Burdock | Catchfly Night flowering | Chickweed | Cleavers | Cocklebur Cow | Cocklebur | Corn Spurry | Dandelion | Flixweed | Galinsoga Hairy | Goat's Beard | Goosefoot Oakleaved | Hemp | Knotweed Prostrate | Kochia | Lamb's-Quarters | Lettuce Prickly | Mustard Ball | Mustard Dog | Mustard Hare's ear | Mustard Indian | Mustard Tansy | Mustard Tumble | Mustard Wild | Mustard Wormseed | Nightshade | Pigweed Prostrate | Pigweed Red Root | Pigweed Russian | Pigweed Tumble | Purslane | Radish Wild | Ragweed Common | Ragweed False | Ragweed Giant | Rapeseed Volunteer | Russian thistle | Shepherd's Purse | Annual Smartweed Species Lady's Thumb | Sow Thistle (Annual) | Sow Thistle (Perennial) | Spurge Thyme-leaved | Stinkweed | Sunflower Prairie | Sunflower Volunteer | Sweet Clover White | Thistle Canada |
|---|---|---

FORAGE CROPS

GRASSES

Crops and varieties are listed in alphabetical order.

*Bluegrass**

Bromegrass
- Baylor
- Beacon
- Blair
- Carlton
- Lincoln
- Magna

*Creeping Red Fescue**

Crested Wheatgrass
- Nordan
- Parkway

Intermediate Wheatgrass
- Chief

Meadow Fescue
- Ensign
- Trader

Orchardgrass
- Frode
- Kay

*Reed Canarygrass**

Russian Wild Ryegrass
- Sawki

Slender Wheatgrass
- Revenue

Tall Wheatgrass
- Orbit

Timothy
- Champ — Pasture type
- Climax — Hay type

*Insufficient data available for variety recommendation.

Adaptation

Crop	Uses	Seeding Rate kg/ha (lb/acre) Forage	Seed	Time to Harvest Hay	Seed
A. All Soils Except Where Drainage is poor					
Bromegrass	Pasture, Hay, Seed	8(7)	3(3)	Early heading	*
Intermediate Wheatgrass	Pasture, Hay, Seed	8(7)	4(4)	Early heading	*
Russian Wild Ryegrass	Seed		7(6)		*
Slender Wheatgrass	Seed		6(5)		*
Tall Wheatgrass	Seed		9(8)		*
B. Soils With Ample Moisture, Good Drainage					
Creeping Red Fescue	Pasture	4(4)			
Meadow Fescue	Pasture, Seed	6(5)	3(3)		*
Orchardgrass	Hay, Pasture	7(6)		Early heading	
Timothy	Hay, Pasture, Seed	2(2)	2(2)	Early heading	*
C. Light Soils and Areas Deficient in Moisture					
Crested Wheatgrass	Hay, Pasture, Seed	8(7)	3(3)	Early heading	*
Russian Wild Ryegrass	Pasture	9(8)			
D. Poorly Drained Areas Subject to Temporary Flooding					
Reed Canarygrass	Hay, Pasture, Seed	7(6)	4(4)	Early heading	*
Timothy	Hay, Pasture, Seed	2(2)	2(2)	Early heading	*
E. Saline (White Alkali) Soils**					
Russian Wild Ryegrass	Pasture	9(8)			
Slender Wheatgrass	Hay	9(8)		Early heading	
Tall Wheatgrass	Hay	11(10)		Early heading	
F. Organic Soils					
Grow winter-hardy grasses — bluegrass, bromegrass, creeping red fescue, intermediate wheatgrass, reed canarygrass, slender wheatgrass, and timothy.					

NOTE: *Swath when first heads are beginning to shell.

**See M.D.A. bulletin — The Nature of Management of Saline Soils.

Seeding

Seed as early as possible in the spring. If moisture supplies are adequate, grasses may be sown in August. The seedbed should be firm and the seed placed at a depth of less than 2.5 cm (1 inch). For rates see adaptation chart.

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

For new grass stands, phosphorus fertilizer can be applied most effectively by banding the material 2.5 cm (1 inch) to the side and 2.5 cm (1 inch) below the seed. If phosphorus cannot be banded, incorporate it and all other fertilizer materials into the soil before seeding.

Annual broadcast applications of fertilizer on established grass crops may be in late fall or early spring. Do not apply fertilizer to frozen soils subject to water runoff. Established grass stands should be fertilized with granular fertilizers. Nitrogen solutions

sprayed onto established grass stands have been found unsatisfactory and this application technique is not recommended.

	ANNUAL RATE OF NUTRIENT TO ADD					
	N		P_2O_5			
New Stands	**kg/ha**	**lb/acre**	**kg/ha**	**lb/acre**	**K_2O**	**S**
Fallow	0-20	0-18	30-50	27-45	(1)	(2)
Stubble	45-70	40-62	30-50	27-45	(1)	(2)
Established Stands	100-120	89-107	20-35	18-31	(1)	(2)

(1) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 35 to 70 kg/ha (31 to 62 lb/acre) of potash (K_2O) for established stands and 50-100 kg/ha (45 to 89 lb/acre) of potash (K_2O) for new stands.

(2) Low sulphur levels can occur in any Manitoba soil. For information on the application of different forms of sulphur fertilizer, see page 18.

Timing

A. **For Seed Production**

Meadow Fescue	**October OR April**
Timothy	**October OR April**
Bromegrass	**Right After Harvest**
Russian Wild Ryegrass	**Right After Harvest**
Wheatgrass	**Right After Harvest**

B. **Forage Production**

The relative efficiency of broadcasting granular nitrogen fertilizers to established grass at different times of the year is as follows:

(1) Spring Application	**April to mid-May — 100**
(2) Fall Application	**October — 78**

Weed Control

For recommended herbicides see Table 9.

Disease Control

Leaf diseases are the most commonly encountered and conspicuous disease problem with the forage grasses. If the incidence of leaf disease becomes severe rotate the field to other crops for several years.

Ergot can be a serious problem on bromegrass and wheatgrasses. Mowing the grass at heading time will prevent the formation of ergot bodies in the developing florets. This also stops spread of the disease to nearby fields of rye, triticale, wheat, or barley. After breaking up a seed field where ergot has been a problem avoid rye, triticale, wheat, or barley for one year.

Harvesting and Storage

For best quality fodder, cut grasses in the boot stage or at the latest in the early head stage. Remove the fodder from the field as quickly as possible and store to protect it from the weather. For detailed information see *Hay and Storage Harvesting Methods* and *Silage and Silos*, Manitoba Agriculture. For pedigreed seed production information, see Circular 6-80. *Regulations and Procedures for Pedigreed Seed Production* and *Pedigreed Forage Seed Production* from the Canadian Seed Growers' Association.

LEGUMES

Crops and varieties are listed in alphabetical order.

Alfalfa

*Early Maturing**		*Medium Maturing**	
Anchor	Hay type	Algonquin	Hay type
Angus	Hay type	Beaver	Hay type
Apollo	Hay type	Pickstar	Hay type
Banner	Hay type	520	Hay type
Chimo	Hay type	Rambler	Pasture type
Hunter	Hay type	Rangelander	Hay & Pasture type
Thor	Hay type	Vernal	Hay type

*Alsike Clover***

Birdsfoot Trefoil

Cree	For seed and pasture
Empire	For seed and pasture
Leo	For seed and pasture

*Red Clover***

Sweet clover

Norgold	Yellow blossom, low coumarin
Polara	White blossom, low coumarin
Yukon	Yellow blossom

*Both early and medium maturing alfalfa are recommended in Manitoba. The early maturing varieties develop quickly in the spring and provide more and earlier regrowth than medium maturing varieties. The medium maturing varieties are more winter hardy.

**Insufficient data available for variety recommendation.

ALFALFA VARIETIES — YIELD as % of Beaver

	Brandon		Winnipeg	
	1972-79	1977-81	1977-81	1978-81
Algonquin	—	127	98	97
Anchor	109	—	—	92
Angus	—	104	99	104
Apollo	—	123	93	106
Banner	—	104	105	101
Beaver	100	100	100	100
Chimo	95	—	—	105
Hunter	—	115	104	—
Pickstar	—	113	98	—
520	—	134	98	105
Rambler	97	92	87	92
Rangelander	—	111	90	104
Thor	—	111	101	103
Vernal	81	107	100	102
Beaver D.M. kg/ha	8113	4996	6815	6671
Beaver D.M. lb/acre	7237	4457	6079	5951

Adaptation

		Seeding Rate kg/ha (lb/acre)		Time to Harvest	
Crop	Uses	Forage	Seed	Hay	Seed
A. All Soil Zones Except Where Drainage is poor					
Alfalfa	Hay, Seed, Pasture	7(6)	2(2)	Early bud stage	Pods brown
Sweet clover	Hay and Seed	11(10)	7(6)	Early bud stage	Pods brown
B. Soils With Ample Moisture, Good Drainage					
Birdsfoot Trefoil	Seed and Pasture	2(2)	2(2)		**
Red Clover	Hay and Seed	7(6)	3(3)	Early bud stage	Pods brown
C. Poorly Drained Areas Subject to Temporary Flooding					
Alsike	Hay, Seed	4(4)	2(2)	Early bud stage	Pods brown
Birdsfoot Trefoil	Seed, Pasture	2(2)	2(2)		**
D. Saline (White Alkali) Soils*					
Alfalfa	Hay	7(6)		Early bud stage	
Sweet clover	Hay	11(10)		Bud stage	

NOTE: *See M.D.A. bulletin — The Nature and Management of Saline Soils.

**for time to harvest seed, consult your seed dealer or local agronomist as shattering is a problem.

Seeding

Seed as early as possible in the spring. The seedbed should be firm with the seed placed at a depth of less than 2.5 cm (1 inch). For rates of seeding see the adaptation chart.

NOTE: *All legumes should be inoculated prior to seeding with an appropriate strain of Rhizobium bacteria. (See Agriculture Canada publication 1299 Legume Inoculation and the Manitoba Agriculture factsheet Legume Inoculation).*

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

For new legume stands, phosphorus fertilizer can be applied most effectively by banding the material 2.5 cm (1 inch) to the side and 2.5 cm (1 inch) below the seed. If phosphorus cannot be banded, then phosphorus and all other fertilizer materials should be incorporated into the soil before seeding.

Annual applications of fertilizer on established legume crops may be in the fall or early spring. Do not apply fertilizer to frozen soils subject to water runoff.

Additional information is contained in Manitoba Agriculture factsheet *Fertilizing Alfalfa Forage*, Agdex 541.

ANNUAL RATE OF NUTRIENT TO ADD

	N		P_2O_5			
	kg/ha	lb/acre	kg/ha	lb/acre	K_2O	S
New Stands	0	0	60-85	54-76	(1)	(2)
Established Stands	0	0	45-60	40-54	(1)	(2)

(1) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 65 to 170 kg/ha (58 to 152 lb/acre) of potash (K_2O) at the time of establishment or 45 to 110 kg/ha (40 to 98 lb/acre) of potash (K_2O) for established stands.

(2) 30 kg/ha (27 lb/acre) of sulphur (S) are recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. For information on the application of different forms of sulphur fertilizer see page 18.

Weed Control

For recommended herbicides see Table 9.

Desiccation

Alfalfa, birdsfoot trefoil and red clover for seed production only.

Desiccation may be used to chemically accelerate the drying of plants. It does not speed crop maturity but will reduce the time from maturity to harvest. See the *Guide to Chemical Weed Control* for specific recommendations.

Disease Control

Forage legumes are susceptible to a number of leaf spot diseases. They are also affected by root and crown rots which may be associated with winter injury.

Foliage diseases over-winter on infected stubble and may build up to become a serious problem. Take severely infested fields out of production. Cut before leaf drop to minimize leaf loss, reducing the amount of over-wintering disease. Early spring burning prior to new growth may also reduce leaf and stem diseases. Rotate with cereals or corn for at least one year before replanting to a forage legume (see Table 1).

Alfalfa and sweet clover are susceptible to Verticillium wilt. To prevent its introduction plant alfalfa seed treated with the fungicide thiram. Avoid potatoes and sunflowers, because of common susceptibility to Verticillium wilt, in the rotation.

Harvesting and Storage

For best quality fodder, cut legumes in the early bud stage or at the latest in the early bloom stage. Remove fodder from the field as quickly as possible and store to protect it from the weather. Detailed information is included in the Manitoba Agriculture publications *Hay and Forage Harvesting Methods* and *Silage and Silos*. Pedigreed seed production information, is contained in Circular 6-80, *Regulations and Procedures for Pedigreed Seed Production* from the Canadian Seed Growers Association.

FORAGE MIXTURES

For recommended varieties, see pages 78 and 81.

Mixtures	Uses	Seeding Rate kg/ha (lb/acre)	Time to harvest
A. All Soils Except Where Drainage is Poor			
Bromegrass	Hay, Pasture	7(6)	Alfalfa in bud
and Alfalfa		3(3)	
Intermediate Wheatgrass	Hay, Pasture	7(6)	Alfalfa in bud
and Alfalfa		3(3)	
B. Soils With Ample Moisture, Good Drainage			
Orchardgrass	Hay, Pasture	7(6)	Early heading
and Timothy		2(2)	
Timothy	Hay, Pasture	2(2)	Alfalfa in bud
and Alfalfa		3(3)	
Orchardgrass,	Hay, Pasture	7(6)	Alfalfa in bud
Timothy		2(2)	
and Alfalfa		2(2)	
Timothy and	Pasture	2(2)	
Birdsfood Trefoil		2(2)	
C. Poorly Drained Areas Subject to Temporary Flooding			
Reed Canarygrass,	Pasture	9(8)	
Timothy and		2(2)	
Birdsfoot Trefoil		2(2)	
Reed Canarygrass,	Hay	9(8)	Early heading
Timothy and		2(2)	
Alsike Clover		4(4)	
D. Light Soils and Areas Deficient in Moisture			
Crested Wheatgrass and	Hay, Pasture	8(7)	Alfalfa in bud
Alfalfa		2(2)	
E. Saline (White Alkali) Soils*			
Tall Wheatgrass,	Hay	5(5)	Early heading
Slender Wheatgrass,		5(5)	
Alfalfa and		3(3)	
Sweet Clover		3(3)	

NOTE: *See M.D.A. bulletin — The Nature and Management of Saline Soils.

Seeding

Seed as early as possible in the spring in a firm seedbed. Place seed at a depth of less than 2.5 cm (1 inch). Seeding rates shown in the above table are approximate. Under favourable conditions these rates may be reduced.

NOTE: *All legumes should be inoculated prior to seeding with an appropriate strain of Rhizobium bacteria. (See Agriculture Canada publication 1299 Legume Inoculation and the Manitoba Agriculture factsheet Legume Inoculation).*

Fertilizer

For specific recommendations have your soil tested. Take samples at depths of 0 to 15 cm (0 to 6 inches) and 15 to 60 cm (6 to 24 inches).

For new grass-legume stands, phosphorus fertilizer can be applied most effectively by banding the material 2.5 cm (1 inch) to the side and 2.5 cm (1 inch) below the seed. If phosphorus cannot be banded, then incorporate phosphorus and all other fertilizer materials into the soil before seeding.

Annual applications of fertilizer on established grass-legume mixtures may be in the fall or early spring. Do not apply fertilizer to frozen soils subject to water runoff.

For the purpose of this recommendation a grass-legume mixture is one which contains greater than 25 percent legume in the sward. If there is less than 25 per cent legume in the sward use the recommendation for a grass stand.

	ANNUAL RATE OF NUTRIENT TO ADD					
	N		P_2O_5			
	kg/ha	lb/acre	kg/ha	lb/acre	K_2O	S
New Stands	0	0	60-85	54-76	(1)	(2)
Established Stands	0	0	45-60	40-54	(1)	(2)

(1) Sands, sandy loam and organic soils are frequently low in available potassium. On these soils apply 65 to 70 kg/ha (58 to 152 lb/acre) of potash (K_2O) at the time of establishment or 45 to 110 kg/ha (40 to 98 lb/acre) of potash (K_2O) for established stands.

(2) 30 kg/ha (27 lb/acre) of sulphur (S) are recommended on well-drained sandy soils and grey luvisol (grey wooded) soils. For information on the application of different forms of sulphur fertilizer see page 18.

Weed Control

For recommended herbicides see Table 9.

Harvesting and Storage

For best quality fodder, cut mixtures when the legume is in the early bud stage or at the latest in the early bloom stage. Remove fodder from the field as quickly as possible and store to protect it from the weather. For detailed information see the publications *Hay and Forage Harvesting Methods* and *Silage and Silos*, available from Manitoba Agriculture.

TABLE 9 — 1983 FORAGE CROPS CHART RECOMMENDED HERBICIDES

HERBICIDES \ CROPS	GRASSES											SEEDLING LEGUMES						ESTABLISHED LEGUMES						COVER CROPS			
	Bromegrass	Creeping Red Fescue	Crested Wheatgrass	Intermediate Wheatgrass	Kentucky Bluegrass	Meadow Fescue	Orchardgrass	Reed Canarygrass	Russian Wild Ryegrass	Slender Wheatgrass	Tall Wheatgrass	Timothy	Alfalfa	Alsike Clover	Red Clover	Sweet Clover	Trefoil	White Dutch Clover	Alfalfa	Alsike Clover	Red Clover	Sweet Clover	Trefoil	White Dutch Clover	Barley	Flax	Oats	Wheat
Asulox F													X[1]						X[1]							X		
Avadex BW													X[2]	X[2]	X[2]	X[2]	X[2]	X[2]							X	X		X
Avenge 200C	X[2]	X[2]	X[2]		X[2]		X[2]	X[2]	X[2]			X[2]	X[2]		X[2]	X[2]	X[2]								X			X
Banvel	X[3]	X[3]	X[3]	X[3]					X[3]																X			X
Carbyne 2EC, Wypout, Wypout 250	X	X[4]	X[4]						X			X[4]	X	X	X	X			X	X	X	X			X	X		X
Cobutox, Embutox E, 2,4-D Butyric 400													X	X			X	X							X		X	X
Dalapon, Dowpon, Dowpon M, Basfapon													X				X									X		
Eptam													X				X											
Hoe-Grass	X[5]	X[5]	X[5]	X[5]					X[5]				X[5]		X[5]	X[5]									X	X		X
Mataven	X[4]	X[4]		X[4]		X[4]			X[4]				X[4]															X
MCPA or 2,4-D	X[6]	X[6]	X[6]	X[6]	X[6]	X[6]	X[6]	X[6]	X[6]	X[6]	X[6]	X[6]	X[7]	X[7]	X[7]			X[7]	X[8]						X	X[9]	X[9]	X
Princep Nine-T, Simadex 80W, Simadex Flowable, Simazine 80W																			X[10]				X					
Roundup	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]	X[11]							X[11]	X[11]	X[11]	X[11]
Sinbar																			X									
Torch	X[4]	X[4]	X[4]	X[4]		X[4]	X[4]	X[4]	X[4]	X[4]	X[4]	X[4]													X	X	X	X
Tropotox Plus														X	X			X							X		X	X

NOTES CROPS

X — Product is recommended for the crop

1 Use Asulox F only on alfalfa intended for seed production

2 Use only on seedling grasses or legumes which are underseeded

3 Established crops to be used for forage only. In seedling year, use only on red fescue

4 For seed production only, only in the seedling year. Do not graze or harvest for livestock feed in the year of treatment

5 Use only in the year of establishment. Do not graze or harvest for livestock in the year of treatment

6 Use only 2,4-D amine. Not all brands are registered for this use

7 Use only when underseeded to flax. Do not use 2,4-D on flax

8 For use as a spot treatment only to control red bartsia

9 Do not use 2,4-D on flax or oats

10 Do not apply in the seedling year. Use Princep Nine-T only

11 Seedling year only. Apply preplant or preemergence to crop but postemergence to weeds

COST OF SEED — 40 HECTARES WHEAT

Using own grain for seed (2700 kg)

Trucking to seed cleaning plant 50 km away and return	$ 60.00
Cost of cleaning at 11.00/t	29.00
Germination test	12.00
Value of wheat No. 1 C.W.R.S. at $170.00/t	459.00
TOTAL	$560.00
Considering 20% cleanout, the screenings (15% dockage) would be worth approximately 15¢/kg	
Therefore 460 kg at 15¢ =	$ 69.00
Total cost is $560.00 - 69.00 =	491.00
Subtracting 540 kg cleanout from 2700 kg leaves 2160 kg at a cost of $491.00 or 22.8¢/kg. To seed 40 ha will require 2700 kg. Therefore, the total cost will be	$615.00

To purchase 2700 kg bulk certified seed

Trucking to seed plant and return	$ 60.00
Cost of bulk certified seed at 28¢/kg	756.00
	$816.00

Three years experimental results in Manitoba have shown a 75 kg/ha increase in yield where pedigreed seed was used over commercial seed.

A 75 kg/ha increase at a value of 17¢/kg means $12.75/ha extra return by using pedigreed seed for an extra expenditure of $5.03/ha resulting in a net profit of $7.72/ha.

COST OF SEED — 100 ACRES WHEAT

Using own grain for seed (100 bu)

Trucking to seed cleaning plant 30 mi away and return	$ 60.00
Cost of cleaning at .30¢/bu	30.00
Germination test	12.00
Value of wheat No. 1 C.W.R.S. at $170.00/t	460.00
TOTAL	$562.00
Considering 20% cleanout, the screenings (15% dockage) would be worth approximately 58¢/lb	
Therefore 20 bu at $3.50/bu =	$ 70.00
Total cost is $562.00 - 70.00 =	492.00
Subtracting 20 bu cleanout from 100 bu leaves 80 bu at a cost of $492.00 or $6.15/bu. To seed 100 acres will require 100 bu. Therefore, the total cost will be	$615.00

To purchase 100 bu bulk certified seed

Trucking to seed plant and return	$ 60.00
Cost of bulk certified seed at $7.56/bu	756.00
	$816.00

Three years experimental results in Manitoba have shown a 75 kg/ha increase in yield where pedigreed seed was used over commercial seed.

A 1.1 bu/acre increase at a value of $4.60/bu means $6.44/acre extra return by using pedigreed seed for an extra expenditure of $2.01/acre resulting in a net profit of $3.12/acre.